No. COPP/IT/66/A-I

ALL-INDIA REVIEW

of

MINOR IRRIGATION WORKS

based on

STATE-WISE FIELD STUDIES

COMMITTEE ON PLAN PROJECTS
(Planning Commission)
IRRIGATION TEAM
NEW DELHI
June 1966

LETTER OF TRANSMITTAL

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Leader, Irrigation Team.

Committee on Plan Projects
Planning Commission,
New Delhi.
June 25, 1966.

My dear Nanda Ji,

Irrigation Team completed study of minor irrigation works in fifteen States of India early this year. Reports in respect of eleven States have already been published and those of the remaining four States are under finalisation and printing.

Based on those studies, an All India Review has now been got out bearing on planning, operation and performance of various categories of minor irrigation works. I am enclosing a copy of the same for your perusal.

This review outlines in general terms only broad features of existing state of small irrigation works—more particularly State managed works—in their various aspects. It also identifies the shortfalls observed by the team in their field studies, and throws light on actual development of irrigation through small schemes and how it can be improved upon. Individual State reports, however, portray the picture more effectively.

A few of these studies were conducted under the leadership of my predecessors, late Dr. N. V. Gadgil and Dr. A. N. Khosla. I will, however, like to state that in conducting these studies the team received the fullest cooperation from the concerned authorities in all the States of India, which is gratefully acknowledged.

Shri Shriman Narayan formerly Member (Agri.) Planning Commission and Shri Tarlok Singh, Member (A&T), Planning Commission have taken considerable interest in pursuance of these studies. My thanks are due to them also.

While memebers of the team and other officers and staff have all worked with due deligence, including strenuous field inspections in the remote countrysides of different States, yet I will

like to mention the name of Shri Baleshwar Nath, Member, who shouldered the main responsibility of organising the field studies, focalising attention on deficiencies, having discussions with State authorities at different levels and finally formulating the reports.

With kindest regards,

Yours sincerely,

M. THIRUMALA RAO

Shri G. L. Nanda,
Minister for Home Affairs,
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CHAPTER I

General

1.1. In the agricultural economy of India, Irrigation occupies a very significant place. Of all the inputs needed for successful agricultural operations the foremost is water. So far only about a fifth of the area under cultivation in the country as a whole, gets the benefit of irrigation of one kind or the other. Rest of the area depends on rainfall alone.

1.2. As per statistics for the year 1962-63, area irrigated in the Indian Union stood at 63·53 million acres net (72·578 million acres gross). This net area falls under following categories:—

Government canals	24·074 million acres	
Private canals	2·890	Do.
Tanks	11·688	Do.
Wells	18·943	Do.
Others	5·935	Do.

1.3. If a break-up is sought in terms of major, medium and minor irrigation works as per presently accepted criterion* it would lead to the conclusion that about half of the irrigated acreage in the country is covered by works classed as minor. These works will normally fall under broad categories listed below:—

(*a*) small tanks and reservoirs known by different names in different regions.

(*b*) submergence tanks including bundies providing irrigation through inundation.

(*c*) small anicuts, diversion weirs and bandharas.

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*Presently accepted criterion is governed primarily by capital cost of irrigation projects which specifies that irrigation works costing upto Rs. 15 *lakhs* are treated as minor, those costing between Rs. 15 *lakhs* and Rs 5 *crores* as medium and those costing more than Rs. 5 *crores* as major.

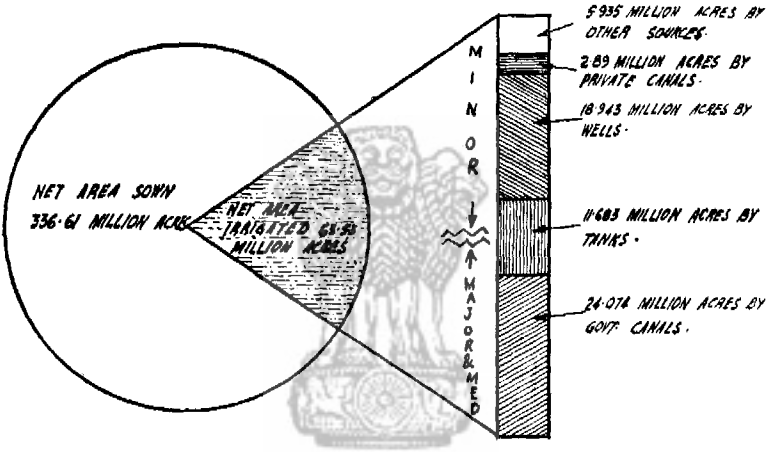


Chart showing sourcewise breakup of the net area irrigated in India (1962-63).

(*d*) open percolation wells including bored wells.

(*e*) tubewells and filter points, and

(*f*) lift irrigation from streams and drains.

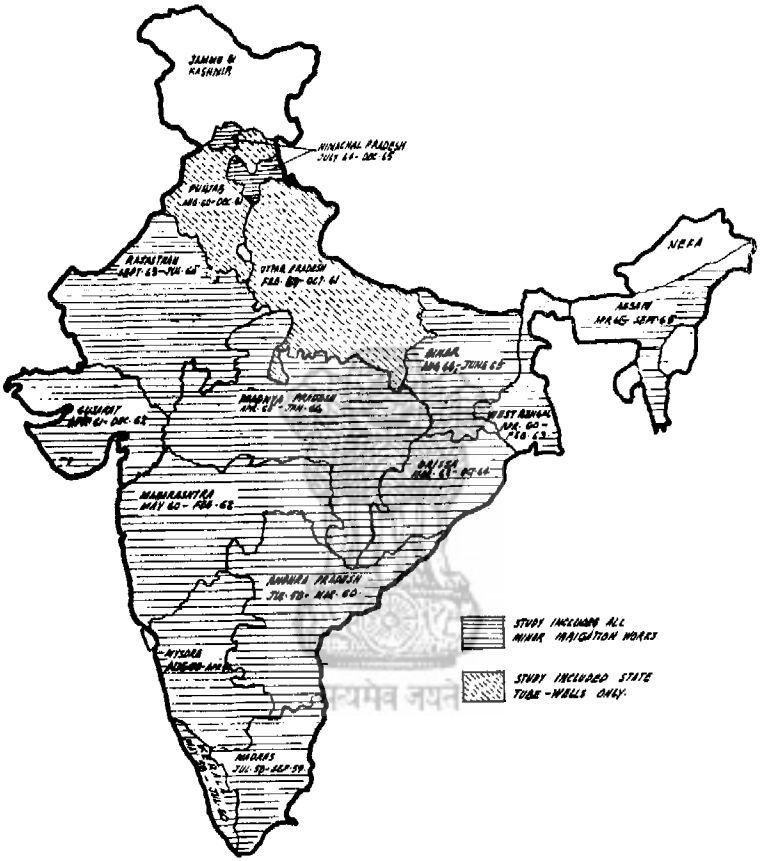
1.4. Of the above categories almost all open percolation wells and some tubewells and filter points are owned privately and are managed by irrigators themselves. The remaining types of works are mostly State-owned. They are looked after by various departments of the State Governments under varying conditions and rules and regulations. Their upkeep and maintenance also varies considerably from region to region. There are numerous local variations in the system and procedures adopted based mostly on old established practices, deviations from which will seem urgently called for in many cases.

1.5. Studies of minor irrigation works were, therefore, undertaken by the Committee on Plan Projects first under Irrigation and Power Team constituted in 1957 under the leadership of Shri N. V. Gadgil. The Terms of Reference as laid down for the study of minor irrigation works are specified in *Appendix I*. Four southern States *viz*. Madras, Kerala, Mysore and Andhra Pradesh were taken up in the first instance and their reports were published in the years 1959 and 1960.

1.6. Later, the Minor Irrigation Team was separated from the Irrigation and Power Team and re-formed under the leadership of Dr. A. N. Khosla, then Member, Planning Commission. Studies were continued on State tubewells in the States of Uttar Pradesh and the Punjab and minor irrigation works of all categories in the State of West Bengal.

1.7. Subsequently in December, 1960 the team was reconstituted under the leadership of Shri M. Thirumala Rao, M.P. and studies were taken up in the States of Maharashtra, Gujarat, Orissa, Rajasthan, Himachal Pradesh, Bihar, Madhya Pradesh and Assam. On winding up of Irrigation and Power team in May, 1964 the Team was redesignated as Irrigation team. Names of Leaders and members of the Team from time to time are shown in *Appendix II*.

1.8. The statement given below (Table I.1) indicates in chronological order the name of the State, scope of study and the period during which study was completed.



Map showing the states taken up for study of Minor Irrigation Works and the period during which field studies were conducted

TABLE 1·1

No.	State	Period of Study	Year of publication	
1	2	3	4	
COPP/MIT/1959/1	Mysore (Interim Report)	Aug. 1958 to April, 1959	April 1959	
COPP/MIT/1959/2	Mysore	Aug. 1958 to April, 1959	September, 1959	
COPP/MIT/1959/3	Madras	July, 1958 to Sept. 1959	November, 1959	
COPP/MIT/1960/4	Andhra Pradesh	July, 1958 to March, 1960	May, 1960	
COPP/MIT/1960/5	Kerala	May, 1958 to July, 1960	July, 1960	
COPP/MIT/1961/6	Uttar Pradesh (Tubewells only)	Feb. 1959 to Oct 1961	October, 1961	
COPP/MIT/1962/7	Punjab (Tubewells only)	August, 1960 to December, 1961	January, 1962	
COPP/MIT/1963/8	West Bengal	April, 1960 to February, 1963	February, 1963	
COPP/MIT/1963/9	Gujarat	April, 1961 to December, 1962	June, 1963	
COPP/MIT/1963/10	Maharashtra	May, 1960 to February, 1962	October, 1963	
COPP/MIT/1964/11	Orissa	March, 1962 to October, 1964	February, 1965	
COPP/IT/1965/12	Rajasthan	September, 1963 to July, 1965	July, 1965	
COPP/IT/1965/13	Bihar	Aug, 1964 to June, 1965		
COPP/IT/1965/14	Assam	April, 1965 to Sept. 1965		Cyclostyled copies of the reports have been sent to concerned State Governments.
COPP/IT/1965/15	Himachal Pradesh	July, 1964 to Dec. 1965		
COPP/IT/1966/16	Madhya Pradesh	April, 1965 to Jan. 1966		

1.9. In this review it is intended to cover different categories of works on a country-wide basis, bringing in observations with a view to suggest improvements as brought out in the study reports of different States of Indian Union. Before taking the works category-wise, it would seem necessary to comment on the administrative and organisational aspects of minor irrigation works in general.

ORGANISATIONAL ASPECTS

1.10. As stated earlier categorisation of minor, major and medium irrigation works is merely financial, yet in actual practice there has occurred a distinct organisational and administrative seclusion of minor irrigation works from the major and medium types of irrigation projects. Though there is a great degree of technical affinity between different categories of irrigation works, yet there exists today a distinct cleavage in their administrative and organisational set-ups, resulting in lack of coordination at almost all levels.

1.11. This unhealthy trend seemingly originated from a bifurcated responsibility in respect of irrigation works of major, medium and minor types vesting at the centre in the Ministries of Irrigation and Power and the Food and Agriculture respectively. While irrigation needs to be looked upon as an integrated item in the development programme of the country, the artificial partition of the effort mobilised in the direction of development of irrigation led to the rise of many a controversy between big and small irrigation schemes.

1.12. In the maze of these controversies the merits and demerits of different types of schemes, which do exist, in the context and background of the areas they are intended to serve, got mixed up and inter-se priorities between different categories of works got vitiated. Accordingly, progress on utilisation of irrigation potential created received a set-back on that account. This has been the general impression of the team in almost all the States of India.

1.13. In fact, actual field studies betray that performance of minor irrigation works had in no way been better than that of major and medium irrigation works, where also there appeared room for improvement. Minor irrigation works by and large, presume a field level performance on the project figures, which is generally not justified by actual field investigation.

1.14. The detailed review of different categories of small irrigation works dealt with in subsequent chapters throws up many other technical and organisational suggestions, which are

based on study-reports pertaining to different States in Indian Union, referred to earlier. If action is planned for effective implementation of the recommendations made in the study reports, the team feels that it will undoubtedly help optimising our agricultural production through better conservation, management and utilisation of our natural resources of land and water.

CHAPTER II

Small Storage Irrigation Works
Tanks and Reservoirs

2.1. Tanks and reservoirs generally include such storage schemes, which impound water of streams and rivers for irrigation purpose. They are feasible mostly in areas where streams can be dammed or bunded. Some tanks are built as partly dug-outs and partly enclosing bunds. Large number of tanks serve (*Nistar*) domestic purposes in addition to meeting irrigational needs. On the whole, however, tank irrigation is mostly practised in peninsular India including Maharashtra and Gujarat. States of West Bengal and Rajasthan too have some irrigation tanks, particularly in their southern and south-eastern regions respectively.

2.2. In the alluvial region of Punjab and Uttar Pradesh as also in Bihar there are not many irrigation tanks. Some irrigation tanks do exist in Bundelkhand area of Uttar Pradesh and undulating terrain of south Bihar.

2.3. At the commencement of the First Five Year Plan the number of tanks in the country was assessed as 5 *lakhs*, distributed in different States of India. These were classified in two categories—as those irrigating below 100 acres and those irrigating 100 acres and above. The Table 2.1 below shows the rough distribution.

TABLE 2·1

(*In hundreds*)

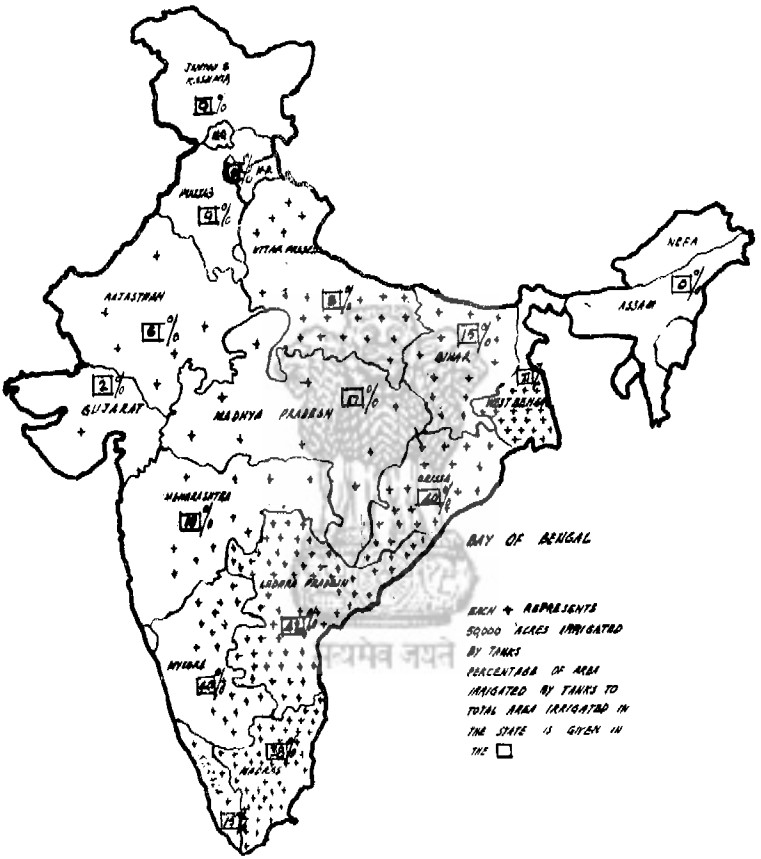
Sl. No.	Name of State/Territory	Below 100 acres	100 acres and above	Total
1	2	3	4	5
1	Andhra Pradesh . . .	483	84	567
2	Assam	Nil	Nil	Nil
3	Bihar	269	9	278
4	Gujarat	192	12	204
5	J & K	..	..	..

1	2	3	4	5
6	Kerala	14	1	15
7	Madhya Pradesh . . .	383	19	402
8	Madras	247	67	314
9	Maharashtra	440	41	481
10	Orissa	12	5	17
11	Mysore	338	27	365
12	Punjab	2	..	2
13	Rajasthan	N.A.	N.A.	N.A.
14	Uttar Pradesh	1,352	48	1,400.
15	West Bengal	N.A.	N.A.	N.A
	TOTAL STATES .			4,995
1	Andamans	..	..	..
2	Delhi	..	..	..
3	Goa	..	..	..
4	Himachal Pradesh . . .	..	..	..
5	Manipur	..	..	..
6	NEFA	..	..	..
7	Pondicherry	1	1	2
8	Tripura	3	..	3
	TOTAL TERRITORIES	4	1	5
	GRAND TOTAL .			5,000

2.4. While progress has been made on construction of new tanks and restoration of old tanks and reservoirs under different plans, the total number thereof may not have increased significantly. While new tanks are built some old tanks go out of use also.

2.5. It was gathered by the team in their study in many states that serviceability of large number of irrigation tanks has gone down considerably in many parts of the country in the past 15 years or so. While agrarian reforms in the shape of Zamindari abolition had been introduced, category of small irrigation tanks, under the care of erstwhile *Zamindars* and *Malguzars* stepped into a domain of no-man's land.

2.6. Tanks and reservoirs, however, occupy a conspicuous place in the complex of irrigated agriculture in the country. Their contribution State-wise towards the total irrigation from all



Tank irrigation in different states of India as also their percentage to total irrigation (1962-63).

sources—major, medium and minor—is given in Table 2.2 below:—

TABLE 2·2*

(*Area in thousand acres*)

Sl. No.	Name of State	Total area irrigated from all sources	Area irrigated from tanks	% age of columns 4/3
1	2	3	4	5
1	Andhra Pradesh . . .	7,418	3,080	41·5
2	Assam	1,533	..	..
3	Bihar	4,933	689	14·9
4	Maharashtra	2,701	477	17·7
5	Gujarat	1,799	41	2·3
6	J & K	699	..	..
7	Kerala	840	112	13·3
8	Madhya Pradesh . . .	2,379	377	15·9
9	Mysore	2,207	888	40·0
10	Orissa	2,571	1,031	40·0
11	Madras	6,151	2,319	37·5
12	Punjab	7,885	14	00·2
13	Rajasthan	4,476	413	9·2
14	Uttar Pradesh	12,533	1,032	8·2
15	West Bengal	3,339	910	27·3
	ALL INDIA TOTAL . . .	61,698	11,319	18·3

**Source* :—Directorate of Economics and Statistics Ministry of Food & Agriculture. (annual average for the period 1950-53)

This shows that almost 18·3 per cent of the total net area irrigated in the country, is served by tanks and reservoirs.

ENGINEERING ASPECTS

2.7. From the point of view of engineering there is not much to comment on the design and construction of minor irrigation tanks. They have been built wherever feasible, mostly on the basis of local observations and the requirements of the areas. In some cases, more particularly in Mysore State—the capacities provided for the tanks were on the low side. Spillways did not seem to cope with the flood discharges they had to negotiate. Bunds and embankments were thus over-topped and

got damaged. Modern method of unit hydrograph was, therefore, recommended in the Team's report for determining the capacities of tanks.

2.8. Some of these tanks had been built centuries ago and do not conform to the latest standards laid down for the purpose. Wherever possible, the team felt that the standard top widths graded according to the height of the bund, with minimum of about 8 feet may be prescribed.

2.9. In some of the tanks the rear slopes have only been turfed. It will be a wise policy to provide stone pitching upto rear flood level instead of mere turfing, wherever stone is available in close proximity. That will minimise chances of breach in the tanks.

ORGANISATIONAL SET-UP

2.10. Though there are different types of organisational set-ups with regard to construction, upkeep and maintenance of tanks, which vary considerably from State to State, yet it is generally observed that they suffer from a sort of casualness with regard to proper maintenance. Apart from Uttar Pradesh, Punjab and Bihar, in the States of Madhya Pradesh and Rajasthan all State irrigation tanks are under the control of Irrigation Department. But, in other States their control is distributed between Irrigation, Agriculture and Revenue Departments. (*See Appendix III*).

2.11. Recently changes are taking place in this organisational set up in view of transferred responsibility with regard to certain types of minor irrigation works under the Panchayati raj institutions. In some States this change has already taken place.

2.12. During the study of minor irrigation works in different States of India a general observation of the team was that works which originally belonged to *Zamindars* or *Malguzars* have fallen into disrepair after the abolition of Zamindari system. As a result their serviceability with regard to irrigation has been considerably reduced. A large number of such tanks exist in the Vidarbha region of Maharashtra State. They are commonly known as Ex-malguzari tanks. For many years past they lay breached and were in dis-use. Maharashtra Government have, however, recently formulated a programme for their renovation.

2.13. Again in West Bengal condition of old Zamindari tanks has been deteriorating. A concerted effort needs to be mobilised to get them renovated. A large number of tanks in Mysore

State also are reported to be in a concerning state. A programme involving heavy expenditure had been formulated for their restoration and renovation. Possibly some institutional changes are called for urgently so that this important irrigation asset in the shape of small irrigation tanks is maintained at proper level and operated efficiently all through.

2.14. Madras State had evolved a system of routine inspection of tanks called "Circle System". In this system each Taluk is divided into a number of circles and detailed technical inspection of minor irrigation works is attended to by rotation at a frequency of once every 4 to 5 years. Each inspection is then followed by necessary repairs.

2.15. To facilitate actual repairs of tanks departmental authorities right down to the village headman are empowered under the Madras Labour Act, 1958, and also the *Khudi Marammat Act* to conscript necessary labour from the beneficiaries on compulsory basis for attending to emergent labour needs. There is, however, slackening of the enforcement of this Act and tanks are falling into disrepair. Active steps need to be taken to enforce provisions of this Act as had been envisaged in the recommendations made by the team in respect of sourthern States.

2.16. Grants for maintenance of P.W.D. tanks are generally given under two distinct systems *i.e.*

(*i*) lump sum is placed at the disposal of each division, which is spent on tanks needing repairs on priority basis,

(*ii*) regular maintenance grants sanctioned for each tank are at fixed per acre rates.

Both the systems have advantages and disadvantages. As recommended by the team a system needs to be evolved by judiciously combining the merits of both. This may require that every tank gets a minimum annual maintenance grant to attend to normal repairs, while at the same time where the needs of situation require it, special funds need to be made available for necessary extraordinary repairs.

2.17. Another observation with regard to tanks which came to the notice of the team is that in recent years the number of cultivators taking out silt from the the tank beds for manurial purposes is falling off. This may be partly due to availability of artificial fertilisers. But, it affects efficiency of the tanks

considerably. A process of automatic desilting of tank beds which used to so operate for ages is going out of vogue. Some obligatory provision may seem necessary to resuscicate that process.

AREAS UNDER TANK BEDS

2.18. Another distressing feature which came to the notice of the Team during their study of irrigation works is the fact that considerable areas come under tank beds. A sample survey assessment made in the State of Mysore, showed that ratio between areas occupied by the tank bed and the ayacut served was on the whole 1:1.2, and in the States of Madras and Andhra Pradesh it stood at 1:1.3. In some cases the ayacut served was found to be less than area occupied by tank bed itself. Again, a sample study made in Bangalore North Taluk on some typical tanks showed that area served mostly got reduced due to silting of the tanks in that area.

2.19. In Madras State a survey of 125 tanks revealed that 13 tanks had silted more than 50 per cent 51 tanks got silted 25 to 50 per cent, 50 tanks between 10 to 25 per cent and 8 tanks less than 10 per cent.

2.20. The team had, therefore, suggested a programme of Desilting-cum-Reclamation of the tanks. Team's recommendations in this respect envisage:—

(*a*) restoration of lost capacity of tanks through removal of silt from tank beds;

(*b*) reduction in evaporation losses in stored water consequenced by shrinkage of water spread area of the tank;

(*c*) reclamation of foreshore land by raising their level with the silt taken out and to subject such lands to agricultural production.

2.21. These recommendations were acceptable to the States of Mysore, Madras and Andhra Pradesh. But the financial involvement and return from the scheme could not be fully appreciated without some trial experiments having been made. Both Madras and Mysore agreed to have some experimental work being taken up of Desilting-cum-Reclamation on some selected tanks.

2.22. While Madras State authorities have been progressing with the D.C.R. scheme and feel that investments made are justified on an overall benefit basis, Mysore tried the experiment on two tanks only.

2.23. Since conditions of rainfall and agricultural requirements and even topographical conditions of the two States are similar, where tank irrigation is practised, it is surprising to find the attitude of the two States towards D.C.R. so much at variance. A concerted policy in this respect needs to be evolved so that the scheme could be implemented wherever it is likely to lead to increase in conservation of water and consequent national production therefrom.

AVOIDABLE LOSSES

2.24. Another disquieting feature faced in respect of tank irrigation is the loss of water through evaporation and percolation. Conditions in India are particularly conducive to heavy evaporation losses in view of vast expanses of water surface, shallow depth of water, abundant growth of weeds in the tank beds and the tropical climate. Weeds are specially responsible for water losses through transpiration which are estimated to be almost as heavy as evaporation losses.

2.25. Average evaporation in different parts of Madras State varies from 58 inches in Coimbatore to 96 inches in Madurai, giving average of 75 inches per year for the State as a whole.

2.26. Actual percolation losses from the bed of the tanks have not been calculated but according to experiments (USAID bulletin No. 71) 8 feet deep subsoil of normal texture is known to absorb as much as 4 feet of water. Percolation losses, however, can partly be recovered from nearby wells by lift irrigation, but evaporation losses are a total loss to the economy.

2.27. In fact, in Maharashtra State there are a large number of percolation tanks which only enrich wells in that area and do not do any direct irrigation. The seeped supplies find their way through fissures into the open wells located below and are utilised mostly through manual lift. In Ajmer area of Rajasthan rapats (small weirs across local streams) serve the same purpose.

2.28. Research has been in progress on minimising evaporation losses from reservoir surfaces through use of monomolecular film provided by organic compounds like cetyle alcohol. Its economics has not yet been worked out but considerable work is being carried on in the country as also abroad. The team in their studies have indicated that use should be made of this technique in conserving supplies in our small reservoirs particularly in areas which are subjected to distress in the month of April and May before monsoons break.

2.29. Along with the use of monomolecular films another step which could minimise evaporation losses could be planting wind breakers on the windward sides of the tanks. Steps in this direction also need to be taken, wherever feasible.

ASSESSMENT OF IRRIGATION

2.30. Though agrarian economy of the country varies only little from region to region, yet there are wide variations in the irrigation rate structure applied in different parts of the country at present.

2.31. Where rates are low the cultivator does not appreciate the value of water and wastes it. Where the rates are high—particularly in the development period of irrigation—the cultivator is shy to make use of water and gambles with rainfall. In other words he waits for rainfall and sees how much he will lose if he were not to irrigate his field, as compared to irrigation charges that he will have to pay, if he were to apply irrigation.

2.32. This tendency on the part of the cultivator results in lower production from his fields. It can be inhibited only if assessment is made on 'two part tariff' basis on all irrigation works including minor excepting only very small works not irrigating more than 50 acres or so, which could with advantage be looked after by Panchayats. This two part tariff will consist of a standing charge over the area protected and a recurring charge of actual irrigation. This standing charge should, however, not be merged with land revenue, because in that case the psychological incentive created through standing charge for the use of irrigation resource is lost.

2.33. In the southern States where the assessment is made on *wet and dry* basis, *wet* assessment leads to complacency on the part of State Departments with regard to maintenance of works, more particularly minor irrigation types of works like tanks, which are widely dispersed and also suffer from poor means of communication. Since there is no fieldwise irrigation recording done, there is no yearly 'tell-tale' available with regard to performance of each irrigation work as is the case where season-wise recording is done. This tendency is, therefore, to let works remain as they are. As a result, in quite a number of tanks in southern States, the ayacuts are actually half or even less than what they were irrigating some years ago.

2.34. The result is that agricultural production from the fields, which do not get irrigation, is adversely affected. It would accordingly seem necessary that field-wise recording of irrigation

is done excepting on petty works irrigating less than 50 acres so as to ensure continued serviceability of irrigation schemes whether big or small. In fact, taking country as a whole, the contribution of small irrigation schemes is in no way less than that of major and medium irrigation schemes. We must have yearly accountability of performance in respect of small irrigation schemes as well, so that their efficiency does not fall.

2.35. Also, the yardstick with which efficiency of an irrigation official could be judged is the return he produces in terms of assessment from his respective charge.

2.36. In some reports of the team, therefore, stress has been laid on the need of placing responsibility of assessment on the producer of water *i.e.* Irrigation Department on a uniform basis throughout the country, as is done in the States of the Punjab and Uttar Pradesh.

2.37. A rationalisation of water rate structure in respect of all types of irrigation works also seems necessary so that it leads to increased production from our irrigated agriculture. A strict uniformity of rates may not be possible but a rationalised approach can certainly be evolved in this direction. If the principle is accepted, the Ministries of Irrigation and Power and Food and Agriculture could urgently examine this question to lay down certain guiding criteria for consideration of the States, as done by Maharashtra Irrigation Commission, 1962, so as to enable them to review the existing irrigation water rates structure.

WASTEFUL FIELD USE

2.38. Another question relating to efficiency from irrigation tanks is the mode of transfer of water from tanks to the fields. It has ben observed that in most of areas field to field irrigation takes place even from small storage tanks, which suffer from shortage of water quite often.

2.39. Though Irrigation Codes and Acts generally envisage that responsibility for constructing and maintaining water courses and field channels beyond outlet is to be borne by the beneficiaries as a customary obligation, yet this obligation does not seem to be fulfilled.

2.40. Planning Commission, more particularly in the Irrigation and Power Division, has been stressing upon the need for a legislation for the purpose. Though their communication pertains to major and medium irrigation projects, yet its application can be extended to minor irrigation works also. Some

States have already taken action thereabout. In others legislations are under consideration. The position as of legislations in this respect in different States of India as could be ascertained is given in *Appendix IV*.

RECENT LEGISLATIONS

2.41. These legislations seek to attain the required end through cooperation of the beneficiaries of irrigation projects failing which the job be done by the State agencies on the basis of charges being recovered from the beneficiaries as arrears of land revenue.

2.42. The team's observation is that the actual impact of these legislations in the field is yet negligible, at least in so far as tank irrigation is concerned. There are still vast areas in the country where field to field irrigation, even from very limited and sometimes scarce resource of irrigation, is practised. How far a change in this respect could be brought about is a matter for serious consideration. In Andhra Pradesh report it has been observed that with a view to accelerate development of irrigation in ayacuts under the new irrigation projects, field channels should be excavated at Government cost subject to a maximum of 25 acres and in the blocks to be irrigated in *dry* areas upto each individual survey number. (See Minor Irrigation Works Report—Andhra Pradesh pages 83-84). This is a deviation from the policy of placing the responsibility for field channels fully on the beneficiaries.

2.43. Again, Chief Minister of West Bengal in his letter No. 707/PS of 19th June, 1963 addressed to Member (NR), Planning Commission observed that *"It would neither be legal nor equitable to compel beneficiaries of an area where water rate is compulsory to construct water courses for the benefit of others."*

2.44. These instances only go to prove that we have no clear cut policy yet arrived at in respect of this important aspect of irrigational practice at field level and that there exists a scepticism in some quarters regarding desirability of having field channels at all.

2.45. The question assumes paramount importance, where we deal with only limited quantities of water as in small irrigation tanks. Possibly with greater insistance on improved technique of transmission of water from irrigation channels to the fields, we may be able to make a greater and more profitable use of water, which is a basic input.

PROJECT COST AND EFFECTIVE COST

2.46. Examining the performance of a number of tanks where necessary statistics were available, team found considerable variations in project cost and effective cost per acre of irrigation. Effective cost was reckoned on the basis of project cost of scheme divided by actual irrigation done by the scheme after running for a number of years. This examination generally showed that project formation had often been done on over estimated targets which brought down project cost per acre in the first instance. Many such case studies are given in the team's reports pertaining to the studies of Maharashtra, Gujarat and Orissa.

2.47. In the four southern States, however, examination of this type was not possible as recording of actual irrigation season by season and on yearly basis is not done in that region. There, the localised system of classification of areas as *wet* and *dry* does not permit of such analysis being made. On the other hand over-estimation of actual irrigation benefits from such works is not unlikely, because all the area provided in the project is generally presumed to receive irrigation benefits from the pertaining works. Variations between project and effective cost cannot, therefore, be found out.

2.48. Again, in many cases efforts have been mobilised to utilise water as envisaged in the scheme. The crop pattern planned on paper was not to be found at site. Extension work on small irrigation works was found to be nil and the development of irrigation from irrigation tanks was by and large, assumed to be the concern of cultivators themselves.

UTILISATION

2.49. In the absence of statistics, which are generally found to be lacking in respect of minor irrigation works, a check up of utilisation of the potential created was generally not possible. In some case, however, such a check up was effected. For example, in the State of Gujarat a sample check up gave a percentage utilisation figure of only 36·3, as brought out in the letter of transmittal pertaining to the report of that State. In the State of Maharashtra in the Nagpur Irrigation Circle such percentage worked out to only 34·6 on minor irrigation reservoirs. Utilisation picture in other States too did not appear to be any better.

2.50. In the Mahakaushal region of Madhya Pradesh small irrigation tanks are looked after by Irrigation Panchayats with regard to utilisation of water and collection of revenue. This system has only a limited scope. So far the Irrigation Panchayats

mostly act as collection agencies for Government dues. They, however, provide a nucleus wherefrom extension work could be motivated in respect of small irrigation tanks, which are numerous in that area and in many other similar regions of the country.

2.51. If a consciousness could be generated with regard to optimum utilisation of water available in small irrigation tanks which are spread all over the country with varying capacities, there could be a good impact therefrom on agricultural production from the areas served by them. The number of such tanks runs into many thousands and effective measures have to be evolved to encompass all such tanks within effective implementation programme for extension work, so that fullest possible advantage is taken of the irrigation resources available through these tanks, which remain, at present, either under-utilised or ill-utilised to a great extent.

2.52. Irrigation tanks in fact form the main stay of agricultural economy in many regions of Indian Sub-continent. In some cases they are the only source of water to meet the domestic requirements of the people. It is, therefore, essential that due attention is given to their upkeep and maintenance, as also to the use of the supplies that become available year after year through such impoundments.

2.53. Attention required by the tanks can be split into two distinct categories:—

(*i*) to increase the existing pondage and to conserve the supplies as far as possible, so as to last longer and to serve greater areas and

(*ii*) to make such use of the available supplies as yield optimum production per unit of water available.

These two aspects one of maximum conservation and the other of optimum utilisation of the supplies need to be looked after by one agency in the field so that conservation consciousness is reflected in the utilisation of supplies conserved to the maximum possible extent. This will entail some institutional changes, which needs must be worked out in the interest of getting maximum return in terms of agricultural production per acre from the areas served or intended to be served by small irrigation tanks in the country.

CHAPTER III

Diversion Weirs and other Small Irrigation Schemes

3.1. For surface water utilisation for irrigational purposes one method adopted was impounding of water in tanks and reservoirs, as discussed earlier. Another technique adopted for the purpose is to divert water from running streams by building bunds, weirs and regulators across them and diverting water on either flank of the streams. Such surface water diversion involves partial raising of the level of water in the stream and leading it out through canal heads or outlets, open or fitted with gate shutters, into irrigation channels run along suitable alignments for use in the fields in the areas commandable on topographical basis.

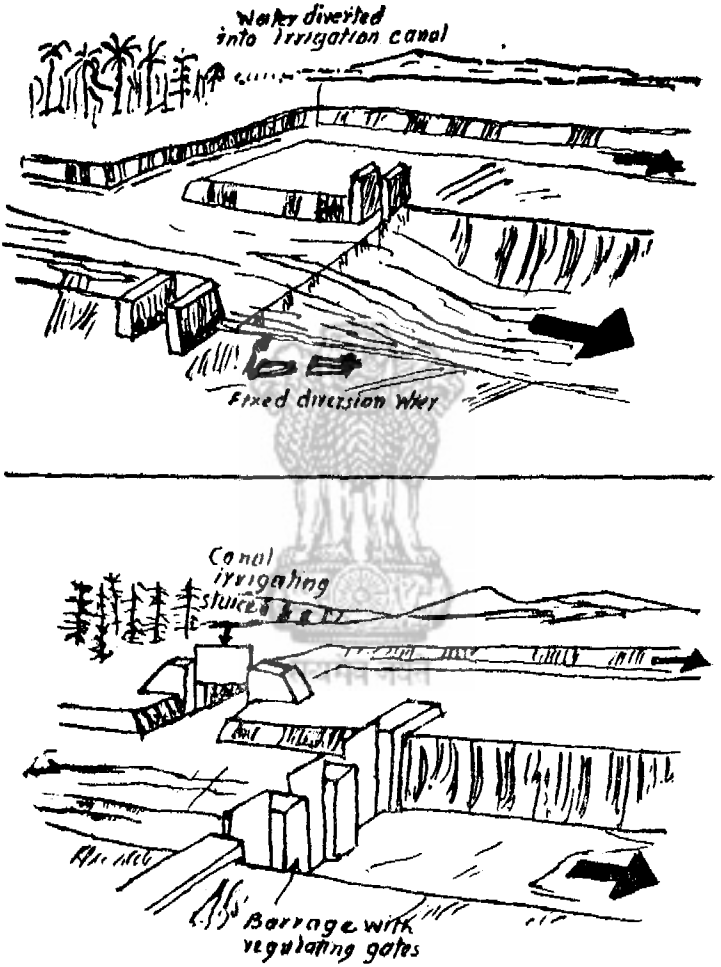
3.2. Such diversion schemes are called *Anicut* in the south, *weirs* in the alluvial plains of the norths, '*kuhls*' in the hilly areas, *bandharas* in Maharashtra, Gujarat and Mysore, *Ahars* and *Pynes* in Bihar *thingal* and *doong* in Assam. There are some other local names too. There are also considerable variations in their design and operations.

3.3. In practically all parts of the country except in the western desert region of Rajasthan there are streams of varying dimensions and varying flows with varying seasonal discharges. As agriculture has developed over the centuries attempts have been made to divert the flow of the streams over to agricultural lands with varying degree of efficiency in practically all the States of India. As such, in the study of small irrigation works diversion *weir* schemes occupy a significant place.

3.4. Where supplies are available all the year round, canals can be taken off from such streams on perennial flow basis. Where, however, streams have sufficient water only during rainy season inundation canals have been in vogue, in many parts of the country.

DESIGNED CALCULATED SECTIONS

3.5. In fact, fore-runner of such works were *kacha* improvised obstructions placed in the streams by enthusiastic



Sketch representation of small diversion weirs.

cultivators for diversion of stream water. Such is still the practice in some parts of the country. In course of time these improvised obstructions have been replaced with masonry weirs built to designed calculated sections.

3.6. However, the team had occasion to visit a number of such works executed in recent years through the agencies of either Revenue or Community Development Departments or Panchayats under the 'Grow More Food Drive'. They were often found to be of sub-standard type both in respect of their technical stability and constructional standards. This deficiency is indeed regretable. It seems necessary to exercise proper and due technical control, where public money is spent—more particularly where hydraulic structures are involved.

3.7. To quote a few, Bhose and Chakan bandharas in Poona district of Maharashtra were so built during Plan periods. The right retaining wall of Bhose bandhara was found collapsed and was lying in that state for two years prior to Team's visit. Chakan bandhara was completed by the Revenue Department in March, 1956. There is no irrigation therefrom. It was reported by the State authorities that the bandhara is defective *i.e.* even after impoundment the water level is below the land to be irrigated.

3.8. There are many such ill-conceived and poorly executed minor irrigation diversion schemes which the Team came across in other States also. It is, therefore, imperative that before deciding upon any diversion scheme—and as a matter of fact for all irrigation schemes—hydrological behaviour of the stream on which they are to be located, feasibility of irrigation in their command, requirement of artificial irrigation and attitude of beneficiaries need to be thoroughly studied, before they are actually implemented.

COMMON MALADIES

3.9. As with other types of minor irrigation works like tanks, diversion schemes too, do not get adequate maintenance attention. During their tour in different parts of India the Team nad occasion to find many common maladies, which could be roughly categorised as below:—

(*i*) Diversion weirs provided with wooden shutters planks or needles often have their planks shutters or needles either missing or in poor state of repairs

(*ii*) The upstream of weirs for want of provision of under-sluices was found silted in many cases with the result that the weir functioned with very low efficiency.

(*iii*) The wings and side walls were often found covered with bushes and grass and were generally in bad state of repairs.

(*iv*) Water gauges were often found missing or not provided at all.

3.10. All these maladies are remediable. This state of affairs persists because there is no regular technical check up on these different items in respect of small diversion weirs and the maintenance responsibility very often rests with non-technical organisation. If a procedure for periodic check up by technical officers is laid down the maintenance of diversion weirs will improve and their performance with regard to irrigation service will also be better.

3.11. On small diversion canals it has often been observed that outlets are not provided on a rationalised basis. The commands are small and water often gets wasted. Another feature in a number of States is that generally night irrigation is not practised with the result that water let out in the channel after sun set is allowed to waste or even if outlets are closed, the water standing overnight in the channel is lost either through percolation or evaporation. Where supplies are meagre, such practices amount to a serious loss of scarce resources.

3.12. In their report on Andhra Pradesh, the Team has showed their preference to piers with gates, as compared to solid weirs. That arrangement will help scouring of beds above, minimise silting up of upstream beds and ensure a better pondage of water than what is otherwise available.

3.13. In the State of Gujarat and Maharashtra what are called *bandharas* are just small diversion weirs. Many such *bandharas* have also been built during the Plan periods. Those built across such streams which do not have any post-monsoon flow, are known as *kharif bandharas*. These *kharif bandharas* mostly do not seem to fulfil their irrigation commitments effectively. If there is good rainfall during *kharif* season they are not utilised and in the *rabi* season there is no water in the stream on which they are located and thus they cannot fulfil irrigation requirements effectively. Any investment on *kharif bandharas* does not lead to much fruitful results. They need not be encouraged.

COORDINATED CONTROL

3.14. There are many streams on which a series of *bandharas* exists. In some areas the series is not looked after by one agency. Coordinated control of such series of *bandharas* will undoubtedly lead to more efficiency by better water management and ultimately to better production therefrom.

3.15. Also, wherever there is possibility of remodelling with a view to enlarge the scope of irrigation therefrom, it needs to be done. This requires closer examination of different systems of bandhararas, wherever possibilities of improvement exist.

3.16. Apart from state managed *bandharas*, there is *phad* system in Maharashtra. Under this system bandharas are managed by the beneficiaries themselves, who generally do not let the water, even when surplus, be used in others' adjoining areas. That sometimes results in supplies available not being subjected to optimum utilisation. Team, therefore, recommends that the system needs re-examination.

3.17. Where *rabi bandharas* have been built it was often found that they do not have sufficient supplies available during winter months. They depend mostly on the post-monsoon flow of the streams, which in some cases does not last long enough to be of much use. It would seem advantageous if this post-monsoon flow is made use of through small storage being created in the upper reaches of the streams, wherever possible.

3.18. Post-monsoon flow in the streams could also be augmented either through terracing or through contour bunding in the upper reaches of the streams. That will at least extend the period of supplies and maximise benefits therefrom. If the supplies could be continued longer so as to cover *rabi* period small diversion works could effectively be used to irrigate *rabi* crops also, as much as possible.

3.19. The system of terracing and bunding in the upper reaches would also enable holding up of water during the rainy season, releasing it after the rains in areas lower down and making use of emergent lands for agricultural purpose. In small irrigation diversion schemes these items often get overlooked and the fullest possible use of the supplies available in the streams is not made.

HILLY AREAS

3.20. Practically all irrigation in the hilly reaches takes place from small diversion weirs put across streams and water diverted along contour channels. These are commonly called *Kuhls*.

Those having only seasonal supplies are called "*Katuls.*" Huge number of such *kuhls* exist in Himachal Pradesh, Garhwal and Kumaon of Uttar Pradesh and ever in Darjeeling hill areas of West Bengal.

3.21. The practice of irrigation from these channels varies considerably from place to place in details. The common feature of these diversion weirs in hilly terrain is their instability. They are usually difficult to approach and are subject to land-slides, cattle trespass and rain cuts etc. They have to be maintained at heavy cost, sometimes to be replaced year after year. In some places the Team came across weirs built during Plan period lying out of repairs for many years and not being attended to by the departmental staff, for the fear that they would get into disrepair soon after.

3.22. Some self-supporting agency has to be evolved which should be saddled with the responsibility of keeping such works without involving the State into yearly capital expenditure on a recurring basis. The Team has felt that Panchayati Raj institutions should be utilised for the purpose to the maximum possible extent within a framework of competent technical supervision.

EFFECT OF ZAMINDARI ABOLITION

3.23. Another type of diversion works are *ahars and pynes* in Bihar. Ahars in fact, are small diversion weirs with a sizable pondage feeding many a small canal system known as *pynes.* They were originally constructed by the erstwhile *zamindars* to protect their paddy areas against small duration droughts. They are numerous and cover a large area of the State. With the abolition of zamindaries, they now vest in the beneficiaries. Where they were of fair dimensions they have been restored by the State at the request of the beneficiaries from minor irrigation grants. But a large percentage of these *ahars* and *pynes* has either fallen into disuse or are gradually losing their capacity.

3.24. As in the case of small storage tanks. some private irrigation works of the type mentioned above in other States too, got into a stage of no-man's charge. Their serviceability got reduced and they began to fall in disrepair. Steps may have to be taken to identify and place them under some responsible charge, so that the assets created in the past do not get liquidated for want of proper organisation.

INSTITUTIONAL DISPARITIES

3.25. In Bihar irrigation schemes under the Bihar Irrigation Act III of 1876 and the Bihar Private Works Act of 1922 are at places intermixed. The former are subject to levy of water rates and the latter are not being levied so far with any water rate and recovery of part cost of the scheme. This leads to jealousy and dissatisfaction among the neighbouring farmers. There are some similar situations faced in some other States too. Anomalies of this nature need to be removed in the interest of wholesome development of irrigated agriculture.

3.26. Again many diversion schemes built originally by the Agriculture Department of the State are generally in a neglected state. An effective technical inspection at regular intervals appears called for in such cases.

3.27. Apart from diversion weirs regulators have been provided in some of the States like Madhya Pradesh, which enable heading up of water across small streams and provide irrigation by submergence to comparatively low lying areas upstream on either bank of the streams for small distances above the regulator. In Madhya Pradesh usually a rate of Rs. 2 per acre is assessed for such irrigation irrespective of crop sown or the number of waterings. Such irrigation is done under periodic lease agreement system.

3.28. In such cases, perpetual lease agreement need to be obtained prior to the sanction of the scheme under the principle of 75 per cent majority as provided in the old C.P. Irrigation Act. Once the regulator starts operating the entire area below the top pond level automatically gets benefited, whether its owner has entered into an agreement or not. These schemes, however, need to be surveyed carefully as in the case of most of the regulators visited by the team the benefited areas were found to have been over-estimated originally.

3.29. In Madhya Pradesh as also in other States it was found that no watercourses and field channels were built on small irrigation schemes and irrigation was done mostly on field to field basis. The areas benefited were thererfore lower than what could otherwise be. Outlet commands of diversion canals also need to be worked out rationally as indicated by the contour of the commanded areas.

STREAMS TO BE NOTIFIED

3.30. Instances also came to the notice of the Team where by virtue of established riparian rights supplies in the streams

were being blocked up in the upper reaches for the sake of small patches of land. This may not have any appreciable effect during rainy season. But, it handicaps lower reaches seriously when the supplies are short and they are needed urgently either for maturing late *kharif* or *rabi* crops in the command of the diversion weirs.

3.31. In the interest of ensuring irrigation supplies in the *ayacut* of the projects on which huge expenditure is incurred, timely action is called for to extinguish such riparian rights. Streams on which irrigation works are located need to be notified in time to enable the Government to cause punitive action for any subsequent infringement.

3.32. In some States the team observed that at certain places water was being lifted through manual or mechanical lifts direct from Government canals. Such interference with the flow of canals is not conducive to the development of a healthy irrigation practice and also disturbs the attainment of the required regime by an irrigation channel. Punitive and administrative action is called for to put a stop to such unauthorised and injurious practice.

UTILISATION

3.33. As in other minor irrigation works, on small diversion schemes too, in most cases, there is no recording of actual irrigation done season after season. There is, however, wide-spread presumption that the area designed to be irrigated is served by these irrigation works year after year. As has been brought out in the Team's studies this presumption leads to inflated impression of actual utilisation of irrigation potential created, as also over-estimation of the benefits therefrom.

3.34. This fact was also brought out in letter No. 3(33)-62-Agri. dated 20th November, 1962 from the Ministry of Community Development, Panchayati Raj and Cooperation, Government of India, to all the State Governments (*Appendix V*). It is indicated in that letter that unutilised potential on minor irrigation works is believed to be higher than that on major and medium irrigation works.

3.35. The above observation got established from the field studies conducted on minor irrigation works in the various States of India. While storage works had been discussed earlier, the position on diversion works is no better. With regard to certain works for which data could be avilable, this position is indicated in Table 3.1.

TABLE 3.1.

Name of the State	No. of works for which information was supplied	Total cost	Targetted irrigation	Actual irrigation	Percentage of utilisation
		Rs.	acres	acres	Rs.
1	2	3	4	5	6
Maharashtra .	146	18,38,204	24,002	9,220	38.4
Gujarat . .	5	30,11,164	11,628	2,898	24.9
Orissa . . .	6	7,63,651	9,265	3,999	43.2
Madhya Pradesh .	5	97,807	1,692	870	51.4
West Bengal . (First Five Year Plan)	16	14,24,000	24,180	12,930	53.4
Second Plan period	5	7,67,000	8,278	4,076	49.2
Rajasthan . .	6	32,74,000	18,606	10,715	57.7

3.36. Under-utilisation may mainly be attributed to two distinct causes:—

(*i*) Inadequate capacity of works to cope with the targets aimed at or ill-planning thereof.

(*ii*) Inadequate attention being given to project construction, their maintenance and operation.

3.37. Dispersed nature and non-spectacular magnitude of minor irrigation works undoubtedly makes them vulnerable to a sort of casualness in their planning and execution. Some diversion works that the Team came across during their field studies have been built, where even offtaking channels are not feasible. There are many other instances of similar nature.

3.38. On many a work, though completed, distribution system has not been built due to land acquisition or similar difficulties. On most of the small irrigation works water-courses and field channels have not been laid out. Some of them suffer from organisational inefficiency. All these factors result in hindrance to the utilisation of available irrigation supplies.

3.39. Such under-utilisation not only dampens the enthusiasm for the planning and execution of minor irrigation works but affects to a great extent agricultural production of the country. A realistic view of poor utilisation and measures for its effective redress are called for.

EFFECTIVE COST PER ACRE

3.40. As was indicated previously in respect of tanks and reserviors wide variations were noticed between project cost and effective cost with respect to diversion works too. In the absence of any procedure for booking of irrigation on small irrigation works, overall picture cannot easily be worked out. The meagre information that the State authorities could provide, reflects that a number of schemes may have been sanctioned on inflated figures so as to keep the project cost per acre within the sanctioned limits fixed for the particular type of work.

3.41. For example in Orissa the Rural Engineering Organisation resurveyed 80 minor irrigation works and found that the actual area of serviceability was 23 per cent less than the area assumed. In the absence of physical recording of irrigation, how much benefit is actually accruing therefrom cannot be justifiably assumed.

3.42. Coordinated efforts of all concerned agencies and departments are needed to be mobilised to accelerate utilisation on small diversion schemes, as and where they are. The gap between project cost and effective cost would then automatically get bridged.

LIFT IRRIGATION SCHEMES

3.43. Lift irrigation from streams and natural ponds is practised in many parts of the country. Lately, floating barges fitted with pumping sets have been introduced in Orissa by the Lift Irrigation Directorate in that State. Two types of barges of house boat type have been designed and fabricated. These mobile barges move from one location to another and provide irrigation facilities to suitable areas on either bank.

3.44. Field operations in a couple of years will indicate its operational difficulties and economic feasibility. Field staff operating these barges will need to be supervised closely, so that scheme does not suffer from usual human frailities.

3.45. Lift irrigation projects from rivers and streams fall under two categories.

(*a*) those operated and maintained by the State, and

(*b*) those which are organised and maintained on a co-operative basis.

In the State of Maharashtra and Gujarat and lately in Orissa lift irrigation schemes have been in use.

3.46. The difficulty generally experienced in lift irrigation schemes is mostly of personal nature and can be solved with organisational and administrative adjustments.

3.47. The cost of lifting water being fairly high, what is required under lift irrigation schemes is economic use of water and judicious crop planning, so that high water consuming crops are not sown, where water is not available in plenty and at economic cost.

STREAM-WISE ASSESSMENT OF IRRIGATION RESOURCES

3.48. In some cases it was observed that lift irrigation schemes have been installed in such reaches where lower down other irrigation works had been built earlier. This had resulted in some cases in depriving the existing works lower down of supplies which would have otherwise naturally flowed down if not lifted up in the upper reaches. To safeguard against such situations the Team had recommended a complete streamwise assessment of irrigation water resources and a comprehensive planning of irrigation of all types. A circular letter isued by Planning Commission at the instance of the Team is given in *Appendix VI.*

3.49. In the vast irrigation complex of the country diversion works—major, medium—occupy the most significant place. Many major irrigation schemes with extensive network of canals, distributaries and minors in the northern alluvial plains and in the deltaic region bordering eastern coast line rank among the world's best. Cumulatively, however, the role of small diversion schemes combined with river pumping and surface water lift schemes discussed in the foregoing paragraphs is not less important. They serve smaller units of areas, but mostly in tracts where major and medium projects are not feasible.

3.50. They are, indeed, not spectacular in appearance but are sufficiently service-worthy to deserve greater attention from the administrative and technical authorities than what has been bestowed upon them so far. Mere provision for funds therefor in various plans is not enough, nor does their constructions alone secure the ends sought. What is required most is their upkeep

and maintenance and utilisation on a sustained production basis. This is the moral that can be deduced from the studies conducted by the Team in different States of Indian Union.

3.51. Regular management units need to be set up specifically, say at district level, which may dovetail into major and medium irrigation units so as to form coordinated irrigation management system on jurisdiction basis. Piecemeal planning of irrigation works more particularly of minor category has generally led to a disjointed planning of irrigation works.

3.52. The result has been inadequate production from and even infructuous investment of money and materials on irrigation works. Such lapses exert unwholesome influence on further extension of irrigation programme, which is so essential for progressing agricultural development in the country.

3.53. In a vastly varying organisational set up that exists in the country with regard to its irrigation works, it is not possible to present ready answers to many a baffling problem that are faced on our agricultural production front today. The team has, however, been able to identify them, as will be clear from various case studies presented in the reports. Solutions can be attempted keeping in view the specific background and particularities of the localities along with their climatic, topographical, geological, social and even political peculiarities. Indications thereabout have been made in the Statewise reports.

3.54. One thing is clear, Irrigation as it is, needs to be viewed in its entirety and not on piecemeal basis. Major, medium or minor all types of irrigation works serve the same end. Their field level technique is also the same. They all involve proper and optimum use of available water for production purposes, that is their end-use, which is, indeed, most important.

CHAPTER IV

Ground Water Resources—Wells and Tubewells

4.1. Exploitation of the fair weather run-off of most of the streams for irrigation purposes has been done extensively. There is difficulty in further surface water supply in most irrigable tracts. But, there exists a vast resource of water in sub-surface supplies, contained in the aquifers below normal water table. These surface supplies too, have been used for irrigation of crops in many parts of the country-more particularly in the northern alluvial plains of U.P. and the Punjab, as also in some suitable areas in other parts of India.

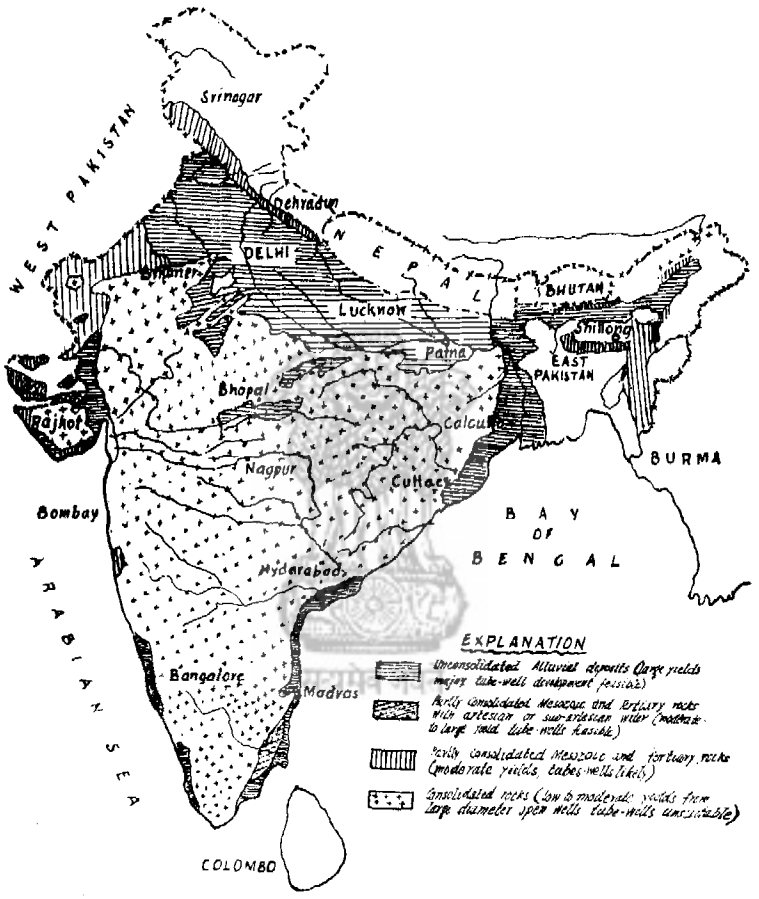
4.2. Shallow peroolation wells generally permit exploitation of the subsoil resource of water only to a very limited extent. They can serve only small holdings. Still, possibilities of further exploitation of this vast subsoil resource through shallow percolation wells exist in a number of States in India. In fact, such a well is the common man's irrigation resource.

COMPOSITE SYSTEMS—WELLS & CANALS

4.3. Of late, thinking is developing in the direction of having a composite system of well-*cum*-canal irrigation more particularly in areas, where subsoil water is coming up with the introduction of canal irigation. And a "well grid" comprising wells suitably located within canal command may eventually lead to a healthy system of irrigated agriculture.

4.4. A rough assessment of open wells in the country places the figure at 50 *lakhs*. During the Plan periods considerable efforts have been made for construction of new wells which generally comprise two types *viz.*, masonry wells in good water bearing stratas and wells in rocky stratas. Besides restoration of old wells, boring and deepening of existing wells has also been attempted.

4.5. Work in connection with open percolation wells has mostly been done through Community Development agencies, directly dealing with individual cultivator or cultivators. Their



Map showing ground water possibilities.

actual performance picture could not be assessed as records thereabout have generally not been kept.

4.6. The team in their fields studies however visited a number of wells in different States of India. In the absence of precise data nothing can be said with certainty about their performances. Open wells performance varies from region to region and from season to season. For example in Gujarat criteria fixed for new and old wells to irrigate 6 and 4 acres respectively is actually reported to average to 3 and 1.75 acres only respectively as per Technical Committee report.

4.7. From the above it will be seen that the presumed area benefited in respect of open percolation wells is on the higher side. However, wells provide good example of economic use of water. Fields have often been found well formed, wherever well irrigation is practised and *kyaries* are also well laid out.

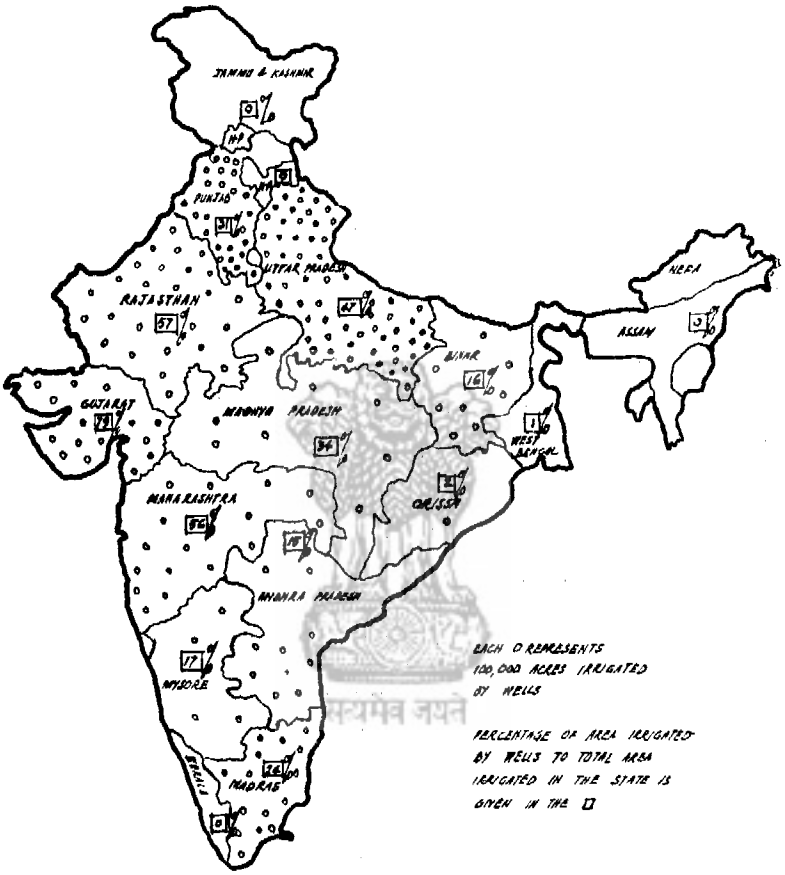
4.8. In operation of open wells there are many varving ways adopted for actual lifting of water. In shallow wells, manual lift with wooden lever arm is often practised. Local variations in this practice are numerous.

ANIMAL DRAFT

4.9. Where animal draft is used for the purpose, one significant feature observed by the team in States of Maharashtra, Gujarat and partly in other adjoining States was that the draft animal were made to retrace their steps up the sloping ramp with their tail towards the well. This, it is felt, is unnatural operation imposed on the animals and should eventually result in impairing their efficiency. Some work study research in this direction may prove rewarding.

4.10. Persian wheels are used extensively in the northern States of the Punjab and western Uttar Pradesh. But, in other parts of the country their use is only sparing. The team felt that where the recuperation in wells is such, as can sustain supplies to persian wheels or similar type of water lifting devices, they could be progressively introduced with advantage.

4.11. Where, however, mechanical lifting is possible and economically feasible the same should be encouraged. But care has to be taken at the same time that draw-off is not such as may lower the water table beyond easily recuperable limits. In some areas the team observed that mechanical pumping from open wells rendered ordinary open wells in the locality dry.



Well irrigation different states of India as also their percentage to total irrigation (1962-63).

4.12. In fact, in all ground water exploitation schemes, an assessment of underground supply needs to be made so that there is no over-drawal. Where, however, draw-off is likely to be heavier than the normal natural input through percolation etc. etc., steps need to be taken to cause as much re-charge as possible.

INTENSIVE OPEN WELLS PROGRAMME

4.13. Attempts are afoot in some areas to have an intensive programme of open percolation wells, along with a programme of deep tubewells. From a long range point of view such programmes may not prove wholesome. As deep tubewells pumping increases the draw-down on water table increases, and in not very favourable ground water conditons, open percolation wells dry up. The result is an infructuous investment on open percolation wells.

4.14. A judicious area planning in respect of open percolation wells and tubewells needs to be done, so that ground water supplies are able to sustain both programmes. The team had occasion to see adverse effect of unheeded pumping on ground water table in many a region, where the common man's common irrigation resource *i.e.* the open percolation wells got dried up, if not permanently, at least when deep well or mechanical pumping from large or bored wells was in progress and when water was most needed.

DEEP WELL PUMPING

4.15. With increased tempo of irrigation development it became clear early in this century in different parts of the world that subsoil water needs to be exploited through deep well pumping for purposes of irrigation. The first experiment and a large scale one was tried in India in Uttar Pradesh immediately after motive power was made available through generation of hydro-electric power from Ganga Canal falls from 1930 onwards.

4.16. Uttar Pradesh has more than 8,000 State tubewells in operation. There are about 1,600 State tubewells in the Punjab, another 2,000 or so in other parts of the country.

4.17. Besides, there are a large number of private tubewells of varying types and capacity in operation in different States of India. In fact, the number of private tubewells is increasing day after day and cumulatively for the country as a whole, they might soon exceed the number of State tubewells.

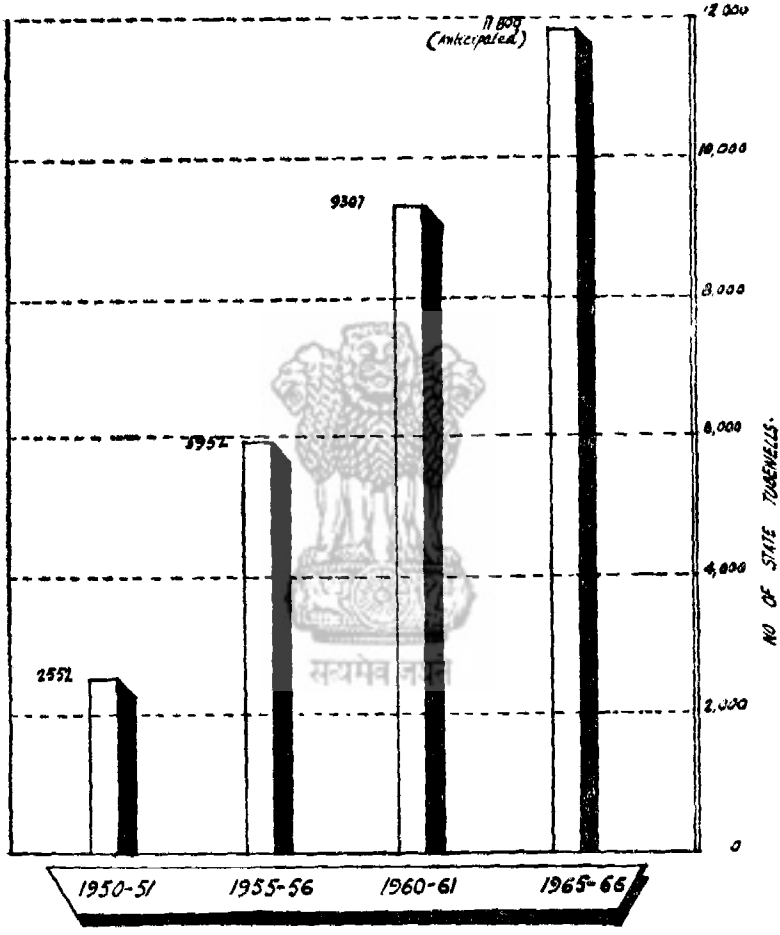


Chart showing development of State tubewells in India during the plan-period.

4.18. The financial picture of State tubewells is, however, baffling and it has caused concern to many State Governments. There are many causes contributing towards this. It is evident that tubewells are not comparable with gravity canals or storage schemes with regard to availability of supply of water.

4.19. Lifting of water from varying depths is a costly operation. Even if motive power is subsidised as is done in many cases, financial picture of State tubewells performance is not heartening.

PLANNING OF STATE TUBEWELLS

4.20. Studies made by the team in the States of Uttar Pradesh and Punjab reveal many of these disquieting features which are suggestive of reappraisal of planning of State tubewells. These studies were primarily desired to explore the possibilities of:—

(*i*) more scientific and judicious location of tubewells projects keeping in view the agro-climatic characteristics of areas;

(*ii*) reduction in the construction cost of tubewells with the help of improved techniques of construction;

(*iii*) reduction in the operation cost of tubewells;

(*iv*) realising greater revenues from beneficiaries;

(*v*) enforcing economies in the actual field use of water;

(*vi*) increase in agricultural production from State tubewells so that beneficiaries could contribute more towards revenues;

(*vii*) removing other extrenuous influences affecting efficiency of State tubewells; and

(*viii*) finding out ways and means for utilisation of other community services.

4.21. The Team studied financial, operational and irrigational aspects of State tubewells in the States of Punjab, Uttar Pradesh, Guajart, West Bengal, Orissa and Madhya Pradesh in connection with the study of minor irrigation works.

4.22. Though the technique of tubewell construction and the agrarian economic structure is more or less similar in all the States yet there exists considerable variance in their planning, operation and performance standards.

4.23. In the State of Punjab 1,483 tubewells were completed during the First and Second Plan periods of which 1,227 were meant for direct irrigation and the remaining 256 were installed under Jagadhari Tubewells Project. The State Government have since adopted a policy of promoting private tubewells and discontinuing further investments on State tubewells.

4.24. Also charges for use of tubewell water were levied in the Punjab on consumption of electricity basis. The cultivator thereby used to pay for the inefficiency of the pumping sets if they were not delivering full quantity of water. While the team in their report recommended rationalisation of water rate structure as has been done in Uttar Pradesh, the Government subsequently took a decision to the effect that users of State Tubewells water will pay water rate on an acreage basis as on open canals.

4.25. This meant that the already bleak financial picture of the State tubewells as brought out in the report of the team may get affected adversely. It is hardly possible to equate the two services—canals and tubewells—because one is based on flow of water from river diversions and the other involves lifting up of water from subsoil resources.

4.26. In Uttar Pradesh first tubeweels project comprising of 1,656 tubewells was taken in hand in 1931 and for another 600 in 1945. This number was increased in subsequent years and the total number of tubewells at the end of 1960 was 6,048. In subsequent years this number has further gone up. The State Government however are progressing with further programme of State tubewells which is different than the policy adopted in the Punjab.

4.27. The culturable commanded areas of the tubewells had been fixed on an excessive side. As a result of team's recommendations, it is gathered U.P. authorities have taken steps to reduce the commands.

COOPERATIVE TUBEWELLS

4.28. 590 cooperative tubewells were installed in Meerut and Moradabad areas by Cooperative Cane Growers Federation and other Cooperative Societies. At the time of team's visit only a few were reported to be working satisfactorily. 124 tubewells out of them were to be taken over by the Irrigation Department at a cost of Rs. 65 lakhs. This step of transfer from Cooperatives to State is different than the attitude

adopted in some other States like Orissa, where State authorities were thinking of transferring State Tubewells to Cooperative Societies.

4.29. Tubewells in Gujarat were built mostly in the erstwhile Baroda State more than 20 years ago. There has been progressive development in this direction ever since. There were about 460 tubewells operating in 1961-62. Groundwater supplies do not seem to be as rich in Gujarat as in northern Indo-Gangetic alluvial region.

4.30. Though it is a matter of close investigation and observation, yet prima-facie an unchecked tubewell programme may not seem desirable in groundwater deficient areas of Gujarat. From the groundwater conservation point of view the team had stressed upon the need of recharging operations to keep the water table replenished.

4.31. On the operations side the team found out that supply of water was stopped to the defaulter cultivators. This is not conducive to optimum utilisation of water. The team stressed upon effective recourse under Section 57 of Bombay Irrigation Act of 1875 for the recovery of arrears of water rates till a regular Tubewell Act is enacted and enforced in the State.

4.32. The team studied closely the financial aspect of tubewells in Gujarat. Since deeper stratas had to be tapped to get adequate discharge as compared to Punjab and Uttar Pradesh, the cost of tubewells in Gujarat worked out to Rs. 81,500/-. Water rates too were higher in Gujarat as compared to Uttar Pradesh.

4.33. Water was supplied at a rate of 10,500 gallons per rupee on a volumetric basis. Besides there are additional charges of Rs. 25/- per acre on *Variali* tobacco, Rs. 15/- per acre on *Zeru* and country tobacco, Rs. 8/- per season on vegetables and Rs. 20/- per acre on cotton. The study revealed that unless a tubewell runs for 5,000 hours in a year it may not be possible to balance its working expenditure.

4.34. West Bengal suffers from deficient subsoil water in part of the State and with abundance thereof in the other. In the regions where there is abundance of water the need for irrigation may not seem pressing for ordinary agricultural operations during normal rainfall years and deep tubewells in those areas may appear financially unproductive, while, in regions where there is deficient subsoil water it is difficult to find adequate discharge in the tubewells.

4.35. As the time of team's visit there were 240 State tubewells in the State out of which only 76 were functioning. Financial picture of 76 tubewells, which were functioning at the time of team's visit was quite concerning. It may have improved since.

RCC DISTRIBUTION PIPE LINES

4.36. One peculiar feature of the tubewells in West Bengal is provision of underground RCC pipeline in the head reach, at a cost of about Rs. 25,000/- per well. Apart from underground pipeline there are *kacha* surface channels also. In this respect West Bengal differs from all the States of India. Inasmuch as the system of distribution of water is concerned it is not only unnecessarily costly but also involves lifting of water to the overhead reservoir.

4.37. Also planning, execution and functioning of State tubewells in West Bengal is with the Agriculture Department, unlike in the States of Uttar Pradesh, Punjab, Guajarat and Bihar where they are in charge of P.W.D. Irrigation Branch. While the State Government have been planning expansion programme the team had emphatically stated that deep tubewells should be installed only in areas where their success is reassuring.

4.38. Government of Orissa started tubewell programme in the districts of Balasore and Cuttack. At the time of team's visit, 21 tubewells had been built of which only 12 were operating. Their performance, however, was poor. In Orissa in the head reach channel mostly overground RCC pipeline supported on pillars were being built on tubewells. A rethinking in this direction was recommended by the team in view of the heavy cost involved in such construction.

4.39. At the time of Team's visit no water rates had been levied on State tubewells in Orissa which were under the charge of Agriculture Department. As stated earlier Orissa State authorities were thinking of handing over the tubewells to the Cooperative Societies of irrigators themselves.

4.40. Madhya Pradesh has 90 State tubewells mostly built during the Plan periods. They are primarily located in the Narmada valley. Some of them are good producers of water. But, on some in spite of good discharges their irrigational performance has been poor. More extension work on those tubewells seemed needed. In Madhya Pradesh too, water is not ordinarily given to cultivators who are in arrears of water charges. The collection responsibility also rests with the

Irrigation Department. This is unlike in other States *viz.* Uttar Pradesh and the Punjab.

4.41. In Bihar the number of State tubewells stood at about 950 at the time of study. During the Third Plan period no addition has been made to the number of State tubewells, nor was there any proposal to increase that number.

4.42. In Bihar tubewells in the area north of Ganga are generally poor performers and those in the area south of Ganga are doing better. On the whole, however, Bihar State tubewells are losing about Rs. 37/- per acre on the area irrigated therefrom. Rates from tubewells also need rationalisation. For example, paddy is allowed on State tubewells on acreage basis at about Rs. 7/- per acre. This rate is ridiculously low.

4.43. In Assam a beginning of tubewell programme has been made. The State is a heavy rainfall area, by and large. At the time of team's visit only a few tubewells had been built. They too were running without any decided policy about the water rate, mode of conveyance of water to the field and crop planning etc.

4.44. The above observations of the team which have been dealt with more elaborately in the respective reports of the States go to show that there is great diversity in planning, execution and operation of State tubewells as between different States of India. It will seem advantageous, if a concerted policy is laid down for tubewell programme in different States with a view to get maximum production from ground water resource.

4.45. Tubewells fortunately provide a water resource all the year round and at the very site of its use. It should, therefore, be possible to do crop planning on dependable and successful pattern and to carry out a programme of promoting scientific agriculture on such units as tubewells provide. A clear cut policy in this direction needs to be evolved through collaboration of irrigation engineers and agriculture staff, wherever tubewell programme is in hand.

CLIMATIC CONDITIONS

4.46. Before tubewell irrigation is introduced study of soil profile is essential. This study is more important in the case of tubewell projects than in the case of other schemes, where water can be had at cheaper cost. Poor soils may not yield results commensurate with the money spent on artificial irrigation with tubewells.

GEOLOGY OF THE AREA TO BE TAPPED

4.47. Tubewells particularly depend for their supply of water on subsoil aquifers. Study of geology of the area is, therefore, of paramount importance, as that alone will indicate the location of water bearing aquifers, if any. In their study of irrigation works in different States of India the team came across many tubewells, which had been sited wrongly.

4.48. Besides presence of water indicated by geological studies, the quantitative examination of yield of water is a matter of great consideration, while locating tubewells. This will depend on the formation of good aquifers and their permeability. If the aquifers are not of good permeability, they may not yield good results in spite of being located in water bearing stratas.

4.49. Again, if there is too fine sand below, narrower strainer slot is required to keep the sand out. But narrower slots are clogged more readily than wider slots. The problem therefore becomes a complicated one.

CHEMISTRY OF WATER

4.50. Another consideration while installation of tubewell project is undertaken, is the examination with regard to chemistry of water. If the tubewell has encrustating properties the discharge from the well will fall off in course of time, because of encrustation of the strainers. It is also to be appreciated that irrigation with lower agricultural quality water is worse than no irrigation.

4.51. Instances came to the notice of the Team during their visit to different States that quality of water in ordinary wells has deteriorated on the introduction of tubewell irrigation in those areas. Greater attention is required to be given to this aspect of tubewell construction.

SITING OF TUBEWELLS

4.52. Siting of tubewells is of paramount importance for irrigation purpose. If the tubewell is sited at low level with regard to area to be irrigated, it will involve unnecessary lifting up of water, because irrigation through gravity from the tubewell will not be possible.

4.53. A number of tubewells were found to be sited without regard to proper location, more particularly in West Bengal, where tubewell water is pumped out first into an overhead tank and then forced into underground RCC distribution network. This involves not only high capital expenditure but increased running cost all through.

4.54. If the land around is not of good gradation, the best location is intersection of water-sheds. If the highest point happens to be a sandy patch, as is the case in some of the Gujarat tubewells, it would seem advisable to avoid such location, because no irrigation would prove useful in such a patch.

CONSTRUCTION OF TUBEWELLS

4.55. Boring technique has since made considerable stride in recent years and advantage should be taken of the latest appliances available. Availability of these appliances and their carriage to site of wells has to be considered while planning a tubewell project. From the point of view of availability of material and construction cost, strainers made with local materials could also be used with advantage.

4.56. In certain locations, where stiff clay formations exist, as in some districts of Uttar Pradesh possibility of cavity type well could be investigated. Where, however, artesian conditions exist partially or fully, the technique of tubewell construction will alter considerably keeping in view the characteristics of artesian supplies.

4.57. Such wells can be good producers of supplies to start with, but their supplies may fall off with time. All these factors need close study before a tubewell project is undertaken in any area.

ORGANISATION

4.58. Organisationally tubewell schemes differ from other existing irrigation schemes. In so far as irrigation itself is concerned, there is only the difference of magnitude with respect to large canal schemes, where too water is ultimately led into fields through small outlet units resembling more or less the tubewell units.

4.59. Tubewells require periodic inspection, lubrication and replacement. Proper inspection schedules have to be laid down for the purpose. Workshops have to be provided adequately

so that the percentage of out of order tubewells is kept at a minimum level. In fact, an ultimate time limit should be fixed for repairs to be carried out.

4.60. There are frequent electric breakdowns and shutdowns faced by tubewell installations. This was the common complaint the team came across during their inspection of tubewell areas. Proper maintenance of transmission lines has to be ensured in planning of tubewell schemes. Quite often non-coordination between electrical maintenance staff and general supervision staff leads to unhappy state of tubewells. A check on and control of their coordinated activities is, therefore, essential at different levels of dealing departments.

4.61. In some areas, it was found that feeder lines to tubewells had been tripped for other subsequent electric loads. This resulted in low voltage at tubewell end and consequently fall in the efficiency of pumping plant. This needs to be avoided.

GROUND WATER RESEARCH

4.62. While ground water resources are very good in some regions of the country, they are utterly inadequate in the others. Successful wells and tubewells are therefore not possible at will everywhere. A judicious view need, therefore, to be taken regarding input and withdrawal of water from ground water resources before planning expansion of wells and tubewells.

4.63. Ground water resource is a reserve store, which can be used for some period following even a drought. It needs, therefore, to be exploited with due care, so that we are not left without any reserve, in case, we have to face any prolonged drought.

4.64. More research is needed with regard to ground water supplies, so that use thereof could be made in the best possible manner for optimising agricultural production from the lands served by ground water resources.

CHAPTER V

Agricultural Aspects—with particular reference to Minor-Irrigation Works.

5.1. Agriculture in most parts of India depends for its moisture needs on the vagaries of monsoon. In good rainfall areas like Assam, West Bengal, Orissa, Andhra Pradesh, Madras, Kerala, irrigation is required mostly as a supplemental need to protect their single crop agriculture against occasional drought. In Mysore, Maharashtra, Gujarat and Bihar too the predominant crops receiving irrigation benefits are that of paddy and to a lesser degree that of sugarcane percentage of other irrigated crops being comparatively small. It is only in Punjab, U.P. (mostly Western U.P.), Rajasthan and North Western M.P. where irrigation is used extensively for other seasonal crops as well.

5.2. Besides rainfall, the nature and depth of soils and the normal daily temperatures effect the need for irrigating various crops considerably. Paucity of irrigation is one of the main reasons for poor yields from crops depending entirely on rainfall. Reliable irrigation resources are limited and their exploitation is an expensive and comparatively slow process. It is, therefore, imperative that wherever they are tapped, they should be put to their optimum use with minimum time lags to derive maximum possible benefit therefrom.

5.3. In fact, the planning, execution and functioning of minor irrigation works in the States have to be viewed in the ultimate analysis, in the perspective of *increased agricultural production.* Providing supply of water for irrigation is not an end in itself but only a *means* intended to augment the production of crops.

5.4. Irrigation can yield best results only if it is accompanied by other factors such as suitable change in the cropping patterns, improving and maintaining the fertility of soils, use of improved varieties of crops, application of chemical fertilisers and green manuring, adoption of plant protection measures and improved cultural practices and many other allied matters.

5.5. Normally with the introduction of irrigation and consequent change over from *dry* to *wet* farming, radical changes

are called for in the cropping patterns and the agricultural practices in the project commands. Stepping up the crop yields therefore forms the focal point upon which all efforts should converge.

5.6. From what the team has seen all over the country, it appears that practically no substantial and sustained efforts have been made to bring about the desired transformation in the commands of minor irrigation schemes which, from their very nature, are small, scattered and difficult to approach. Some of the important factors which need be given special attention while planning and operating minor irrigation works are discussed in the following paragraphs.

LAND CAPABILITY SURVEYS

5.7. On each irrigation project, major, medium or minor cropping recommendations have to be formulated for the different major soil types in various regions. To be able to do this, it is necessary to carry out land-capability-surveys of the areas being brought under irrigation. These surveys are being carried out in some of the States. But, it is noticed that very often they are too superficial to serve the purpose they are meant for.

5.8. In crop production three properties of the soil are of special importance, which should be included in these surveys and studied in detail. They are soil texture, soil structure and soil depth and layers. The capacity of soil to absorb and hold water for plant use depends upon these factors.

5.9. Each soil can hold definite quantity of water under different drainage conditions. Water supplied in excess of retention capacity percolates through the soil and moves out of the root-zone. Good soaking or heavy irrigation is thus harmful rather than beneficial. Soil structure is the key to the property of the soil which effects water utilisation and crop production.

5.10. Unlike soil texture, it can, however, be changed. Excellant soil structure could develop with organic matters. The team noticed that in minor irrigation schemes, even for those of appreciable size, practically no land capability surveys were being conducted.

LAND PREPARATION

5.11. The team observed in many cases the potential created was lying unutilised because the irrigators were not ready to make use of the irrigation water for one reason or the other.

Besides lack of field channels etc. the main reason for poor and inefficient utilisation of water is the existence of big unlevelled fields.

5.12. In order that water may be applied uniformly and economically at every place in the field, the levelling of land within the boundary of each field and its sub-division by field *mendhs* into smaller plots of say 1/8th to 1/4th acre size is essential and the matter deserves special attention.

5.13. At present the responsibility of development of land to be irrigated is mainly left with the farmers themselves, more particularly in the case of minor irrigation works. The conversion of dry land into irrigated land requires lot of labour and capital. Even special equipment such as graders and land levellers are needed. Adequate credit facilities, technical guidance and provision of necessary equipment on hire need be provided to the irrigators for the purpose, side by side with the provision of irrigation water so that it is put to optimum use without much time lag.

5.14. In this connection consolidation of holding is another important aspect which needs attention particularly in the irrigated areas. Small scattered holdings can neither be efficiently cultivated nor irrigated. In most of the States this point has not yet received the attention it deserves.

5.15. Wherever consolidation of holdings is done, its operation should be guided by consideration of water needs of the area, *i.e.* both irrigation and drainage. Lack of these concepts often makes consolidation work not effective enough to increase productivity of the lands consolidated.

5.16. Also steps need be taken at the time of consolidation that fragmentation does not occur again. Some provision in consolidation laws may have to be made against likely and avoidable fragmentations. The team in their visits to different States found consolidation work lagging very much behind desired targets except in the Punjab. A scientific approach towards consolidation was also lacking in most of the areas visited by the team.

5.17. Consolidation operation needs to be viewed not only as a land redistribution operation, but as an operation for conversion of lands from less productive to more productive. For that purpose inclusion of technical personnel in the consolidation works seems essential.

CROPPING PATTERNS—CROP ROTATIONS

5.18. Apart from the question of utilising the limited quantity of water for irrigating maximum area, the basic pre-requisite for development of irrigation on any scheme, howsoever big or small it may be, is the question of economic return, by the introduction of irrigation, to the cultivator. Prior to the introduction of irrigation, mostly rainfed crops are sown in *kharif* and sometimes they are followed in small patches by *rabi* crops mostly at places where open wells exist or where soils are retentive of moisture.

5.19. With the introduction of irrigation there is some change in the cropping pattern. Progressive cultivators try to introduce cash crops. The team, however, observed that the development is generally unplanned and not on sound scientific lines. The fertility of the soil can best be built up and maintained by growing crops in a carefully planned sequence.

5.20. The team observed that irrigators did not generally receive timely and detailed guidance for introducing new crops suited to the irrigated agriculture in their areas so as to enable them to get increased economic return from their lands. Double and even multiple cropping could be planned for areas where perennial water was available or where sub-soil water could be tapped during the dry months. Detailed observations in this respect are made in the State-wise reports. A few of the significant suggestions of the team in this respect are :—

(*i*) In areas where water is not adequate for paddy, production of non-paddy food crops or other suitable cash crops by irrigation should be encouraged. This applies particularly to Andhra, Madras, Kerala, and Mysore. Non-paddy crops like maize, ground-nut, cotton, ragi, wheat, vegetables and fodders yield equally good, if not better returns per acre as compared to paddy.

(*ii*) Late paddy (Aman) variety of West Bengal and Bihar and even in Gujarat and Maharastra could with advantage be replaced by early or mid-late varieties of paddy. This will enable the land to be available for rabi sowing with wheat etc. or legumes which help in maintenance of soil fertility. This will help in introducing healthy crop rotations into the area and in bringing the land under double cropping instead of following the age old practice of raising only paddy year after year in the same land with a ploughed or bare fallow between successive crops.

(*iii*) In areas where perennial irrigation is made available such as on tubewells, the intensity of cropping could be very high. It should be quite easy to introduce some cash crops like vegetable, green manure etc. in addition to main *kharif* and *rabi* crops. Three to four crops could be raised on the same land in a year by practising interplanting (i.e. planting a new crop in between the lines of the standing crop before it is harvested). In Punjab and U.P. the team found some progressive farmers taking additional peas and vegetables like *bhindi* and onion from field sown with sugarcane.

5.21. The State Agriculture Departments should draw a few typical cropping patterns out of the large number of crops including fodders, vegetables and green manures that could allow maximum utilisation both of the land and the available water supply.

5.22. The selected patterns considered suitable for particular areas must be adopted in the demonstration farms located there. Double cropping, generally, involves some adjustments in the sowing time or evolution of early maturing varieties of major crops. The State Agriculture Departments can make the best selection after experimentation and then take up the extension work vigorously to cover up the whole irrigated area.

TRIAL-*CUM*-DEMONSTRATION

5.23. Only a few States have so far set up research centres *cum*-demonstration farms for irrigated agriculture and even these, the team feels, are not concentrating whole-heartedly on the various problems of irrigated agriculture. Even the fundamentals *e.g.* field levelling and provision of field channels were found lacking in some such centres.

5.24. Arrangements for measuring water quantities used in irrigating different fields are either non-existant or are unsatisfactory. The experiments being conducted on these farms are more or less similar to those conducted at any other agricultural research station where irrigation is not a significant feature.

5.25. For the conversion of *dry* into *wet* land, a good deal of research is required on the water requirements of crops (under different soil and climatic conditions) depth and frequency of watering and economics of the new crops desired to be introduced, crop rotation, application of water to the fields, size and shape of irrigated fields, irrigation methods and on size of field channels in relation to soil topography and drainage conditions. etc.

5.26. Mostly these objectives are not being attended to even at the farms primarily set up for the purpose in the commands of new irrigation projects. These objectives need to be clearly stated and appreciated while setting up trial-cum-demonstration farms in irrigated areas.

5.27. Work has also to be initiated for conditions where only limited supply of water is available like those on Minor Irrigation Schemes. This is necessary so as to ensure proper utilisation of costly and scarce irrigation water. The technician and the extension workers have to be fully armed with necessary data to advise the cultivators in land management, water utilisation and crop production under irrigated conditions.

5.28. This is an aspect which requires much greater attention than what it has received hitherto. Cooperation between agriculture and irrigation officers and staff at all levels is a pre-requisite for the success of such farms. It is felt that they should, in fact, be administered by boards consisting of officers from both the departments.

5.29. As far as possible such farms should have a standby reliable arrangement of water supply, such as a tubewell or a number of open wells or a tank, in addition to the canal water so that the experiments being conducted are not affected for want of irrigation water at the right time.

5.30. The establishment of trial-cum-demonstration farms for irrigated agriculture needs to be expanded manifold so that each important irrigated area has at least one such farm. These will go a long way in indicating the best possible patterns in these areas. In addition to stimulate interest and initiate early and extensive changes in the cropping pattern it is necessary to organise a vigorous compaign through layout of demonstration-plots in the irrigators' lands on a no loss basis to the cultivator.

5.31. In other words the cultivators concerned could be assured that if they suffer any loss in the experimentation, that will be made up by the State. This will accelerate the propagation of improved cultivation in irrigated areas and the optimum utilisation of limited supplies of water being made available for irrigation.

WATER REQUIREMENTS AND WATER MANAGEMENT

5.32. Knowledge of the amount of water needed to irrigate adequately a certain area of each crop land is important. The quantity of water to be applied will depend upon the crop as the objective is to wet the soil upto a depth corresponding to

the root zone of the particular crop. Considerable research has been done in the west particularly in U.S.A. in this respect.

5.33. In India, there is some information on water requirement of crops mainly from irrigation experiments in the field and not from simultaneous studies of the physiology of the plant (evapotranspiration). There is thus great need in the country for critical investigation into water requirements of all principal crops as related to the physiology of the plant and to the soil in which the crop is grown and the climate of the area concerned.

5.34. Such investigations would be of significant contribution in water management practices, which are of paramount importance in irrigated agriculture. It has to be appreciated that phenomenal high yields of various crops in U.S.A. and Japan are not only due to extensive use of fertilisers etc. but are mainly due to the scientific water management there.

5.35. Other important factors which help considerably in enhancing production from irrigated agriculture are :—

(*i*) Extensive use of farm-yard-manure and compost and chemical fertilisers as well as green manures and legumes in the crop rotations. It is noticed that even wild growth of "AK" can be used as green manure for paddy and other crops. People in Madras were found making liberal use of this. It could be tried in other States with advantage.

(*ii*) Proper spacing of plants and weed eradication needs special attention in irrigated agriculture as frequent irrigations tend to encourage wild weed growths.

(*iii*) Plant protection measures especially against pests and diseases common to irrigated agriculture.

(*iv*) Use of improved agricultural implements including use of improved water lifting devices from open wells and local stream etc.

(*v*) Use of anti-waterlogging and soil conservation measures.

TRAINING OF EXTENSION SERVICES

5.36. The team feels that both the irrigation and agricultural field staffs should be given short training in coordinated courses covering the necessary elements of irrigational and agricultural norms and practices. For this purpose the training centres at suitable Research Stations or Agricultural Colleges

should be started in each State for the officers and staff of agriculture as well as irrigation departments.

5.37. There is also need to strengthen the curricula and courses at the Engineering and Agricultural Colleges in regard to soil and water conservation and irrigated farming. All these measures are essential so that the staff concerned with the development of irrigation may be able to guide the farmers in improved irrigation and agricultural practices.

5.38. On small irrigation works, the team generally found the same casualness with regard to development of good scientific agriculture, as attends their other aspects. In fact, no irrigation work should be considered too small for being given an indifferent treatment, both with regard to its irrigational and agricultural operation.

CHAPTER VI

In Conclusion

6.1. Study of small irrigation works—commonly called minor irrigation—on an all India basis, which the Irrigation Team of the Committee on Plan Projects was privileged to conduct, throws up many conclusions, which have great significance in developing a comprehensive agro-irrigational programme in the country.

6.2. Foremost of these conclusions is the fact that the so called minor irrigation—combined under all its categories—contributes not a minor but a sizable share in the build-up of irrigated agriculture in the country as a whole. But, small irrigation schemes receive much less attention, both technical and organisational with regard to their planning, execution, operation and maintenance, than what would appear commensurate with the contribution they make. This fact was also brought out in the report of the Royal Commission on Agriculture (1928).*

6.3. In fact, owing to their being made of small non-spectacular units, dispersed at the same time in remote locations, minor irrigation works often fail to attract attention due to them. This lacuna is more pronounced because irrigation in India is not viewed administratively and organisationally in an integrated manner.

NUMEROUS AGENCIES IN THE FIELD

6.4. If the subject of irrigation in all its aspects is dealt with by one Ministry in the Centre and one department at the State level, it may result in a more wholesome programme for development of irrigated agriculture. As at present, irrigation is looked after by numerous agencies in the field. At some places irrigation works existing within the scope of a few miles are managed by three or four agencies. Departments which deal with irrigation in smaller or larger degrees are Irrigation, Agriculture, Revenue, Panchayati Raj institutions, cooperatives and private agencies.

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*Report of the Royal Commission on Agriculture (1928) Pp. 338-344.

6.5. What, however, may seem desirable is to make two distinct divisions of irrigation works *viz.*

(*i*) those built and managed by State agencies, which could with advantage be called works in the public sector, and

(*ii*) those built and managed by the irrigators themselves which may be called irrigation works in the private sector.

6.6. While the former require competent technical handling those in the latter category can generally be managed satisfactorily by the irrigators themselves, with almost capsuled technical guidance. In the context of Panchayati Raj institutions coming up, works under public sector could be divided into two classes —namely, those under the State Irrigation Departments and those under Panchayati Raj institutions.

6.7. This division between State department and Panchayati Raj institutions needs to be worked out on the basis of efficiency of management and optimum use of irigation supplies. At present, there are varying patterns of this division, and in some States, too much reliance has been placed on Panchayats. An uniform working system needs to be evolved.

LACK OF COORDINATION

6.8. Another startling observation of the team is the lack of coordination between Irrigation and Agriculture departments at almost all levels. Irrigation and Agriculture are the two main links in successful irrigated agriculture, which may be called 'Irriculture'. If they do not condescend to merge into one composite effort, the result is a drag on development of successful irrigated agriculture.

6.9. To mitigate all types of mis-understandings and apportionment of blame on each other in a post-mortem fashion that the team came across during their field studies and visits, a unitary control over all field activities in the areas under irrigated agriculture seem inevitable. Exact pattern of such control has to be evolved keeping in view the administrative and organisational background of each area or region.

6.10. This unitary control can be effectively exercised by a unified agency with composite personnel consisting of engineers and agriculturists with party of prospects, functioning without political or other extrenuous interferences.

COMPREHENSIVE POTENTIAL ASSESSMENT

6.11. Also small irrigation works, by and large, have been taken up in different States of India on an *ad hoc* basis. What is required is comprehensive assessment of the potential in different localities and apportionment of priorities to different types or different units of works.

6.12. Steps in this direction were initiated at the instance of the team by Planning Commission sometime ago. Such an assessment will safeguard the State Exchequer from incurring sometime unproductive and even infructuous expenditure on those small irrigation schemes, which cannot sustain the test of time.

6.13. One great defect in small irrigation works including wells in scarcity areas, is low degree of dependability in years of drought. When there is drought the works fail to produce water. When there is good rainfall, the need for water from small irrigation works is hardly felt. They, therefore, do not fulfil their purpose to the extent envisaged in the project reports.

LIFT-*CUM*-FLOW IRRIGATION

6.14. In many areas a composite system of lift-*cum*-flow irrigation by canals and wells will prove beneficial. So far these two resources have been organisationally segregated, with the result that one does not prove handy, when the other fails. A healthy irrigation system can develop only when both surface and sub-surface water resources are used to the maximum possible advantage.

6.15. It would, therefore, seem to be a wise policy if institutional segregation between surface water and ground water use is eliminated and the two resources are used jointly for increasing production from irrigated lands. That will also help keeping down the menace of waterlogging and salinity that appears in some irrigated tracts.

6.16. Possibly the existing water rate structure stands in the way of such combination. A production oriented approach and study in this direction may lead to remove the impediments.

6.17. Open wells in the country form the commonest irrigation resources for the common people. They, however, receive little attention from the technical departments of the States and are mostly handled in layman fashion wherever they exist. It would seem desirable if a technical inspection is made of these units periodically.

GROUND WATER LEGISLATION

6.18. In fact, it is time that ground water legislation is introduced in all such areas, where there is increasing use of ground water resources. Introduction of royalty on all such open wells as tap ground water resources for irrigation purposes depending upon their capacity and their actual useability needs to be considered.

6.19. Such a step will go a long way in completion of statistics with regard to open wells, which are often wanting and deficient. It may also add incentive towards improved and scientific use of the ground water resources, in general.

IRRIGATION PRACTICES

6.20. The irrigation practices vary considerably from State to State and even within a State itself. All such practices cannot be said to be the best. There seems room for improvement everywhere, more particularly with regard to field use of water. It would seem advantageous if an All India review is made of irrigation management and practices. A system promoting optimum production from available resources needs to be evolved so that the best possible use is made of the water to promote agricultural production therefrom.

6.21. For example, tubewells are the most reliable source of water supply. Block system of irrigation, as practised in some areas of Maharashtra and Gujarat, could be introduced on them so that all concerned benefit equitably and development of irrigated agriculture on tubewells is steady and uniform. A resource so dependable as tubewells provide, need not remain unutilised even for a single season. The picture of utilisation of water on State Tubewells, however, is quite depressing in many States of India.

6.22. Volumetric supply leads to most economic use of water. Its application on open canals and small reservoirs does not fall within the range of practicability at present for more than one reason. But, on State tubewells volumetric supply of water can certainly be introduced without difficulty. Yet, in some of the States water is supplied from tubewells on acreage basis, which is not conducive to optimum utilisation of water.

6.23. In some States lease bonds form the basis of irrigation. What lessee actually gains does not remain the concern of the lessor. Lessor in this case being the Government is

thus prone to be indifferent towards optimum use of water in the field and increased production therefrom. From the point of view of increased production this system may also need to be reviewed. In short, there is considerable scope for revision of irrigation practices in different States of India, which is indeed, an uphill task, but needs must be done if we have to seek increased production from our irrigated agriculture.

CODE FOR CONTROL AND DIRECTION OF AGRICULTURE

6.24. While there are rules and regulations governing irrigation in almost all States of India, there hardly exists any Code for control and direction of agriculture in the country. Where irrigation is introduced agriculture has to be developed according to availability of water. It would, therefore, seem worthwhile enjoining control and direction of agricultural operations in Irrigation Codes, wherever necessary. In fact, States may have to seek statutory powers from their respective legislatures more particularly in irrigated areas so that water which, as a precious resource, is made best possible use of.

6.25. Apart from large irrigation works it was observed that field to field irrigation is widely practised on small irrigation works also. This leads to highly uneconomic use of water. Besides, soluble soil minerals get washed away from head reach fields resulting in their over-concentartion in the lower areas. Steps need to be taken to discourage this wasteful practice and to introduce irrigation through well-aligned water courses and field channels, wherever possible.

6.26. This in its turn will also enable fertilisers being applied more efficiently than what is done at present in the system of field to field irrigation.

6.27. Obligation for construction and maintenance of field channels resting with the beneficiaries mostly remains unfulfilled. Even where field channels exist water is not used judiciously and economically. Suitable machinery needs to be devised for the construction, maintenance and upkeep of field channels preferably through collaboration of village panchayats or village cooperatives.

6.28. In the case of non-fulfilment of obligation to maintain water courses as per specified standards, provisions in the respective irrigation codes for getting the necessary repairs done on cost recovery basis, need to be enforced. The recoveries could be realised as arrears of land revenue.

6.29. While increased attention is needed to be given to scientific and optimum utilisation of all irrigation resources— big or small-the importance of proper land formation for scientific irrigated agriculture cannot be over-emphasized. Irrigation laws, rules and regulations may need to be amended to enable land formation being attended to with due care in all irrigated lands.

6.30. Considerable time-lag in completion of works was observed in many irrigation works for want of finalisation of land acquisition proceedings. In many States the existing provisions of Land Acquisition Acts need to be amended, as has been done in the Punjab in recent years.

6.31. In many regions winter cropping is inhibited inspite of availability of irrigation because of the menace of cattle grazing. The menace being universal, Cattle Trespass Acts are not enforced. Possibly, raising of fodder crop on irrigation works and elimination of useless cattle may help getting over the difficulty and may add incentive for increased agricultural production from the land served by irrigation works. The matter warrants urgent policy decision at appropriate level.

WATER RATES

6.32. Since there is no uniform procedure of levy of water rates on minor irrigation works in the country, it was observed that booking of irrigation is not done, particularly where no water rates are charged. In the absence of any record of performance, the picture of utilisation is not reflected by the statistics which are often presumed on figures brought out year after year. To keep a check on operational efficiency of irrigation works it seems imperative to keep correct record of their performance irrespective of whether water rates are levied on them or not.

6.33. The system of assessment of water rates and their scheduling varies widely from State to State. Some sort of rationalisation of charges keeping in consonance with the expenditure incurred in the respective spheres needs to be evolved. There is, however, fair scope for upward revision of water rates.

WET AND DRY ASSESSMENT

6.34. Where permanent assessment on *wet* and *dry* basis exists a sense of complacency generally creeps in the minds of authorities. Maintenance of works often gets neglected because revenue comes into State Exchequer year after year without ascertaining the actual benefits that accrue to the areas supposed to have been served by the irrigation works.

6.35. Wherever within the range of feasibility, a system of water charges consisting of two parts could be introduced with advantage. Such two part tariff envisages a standing charge per acre on the cultivable commanded areas and a recurring charge on the areas actually irrigated season after season. This will also provide incentive to fuller utilisation of water.

6.36. Early and effective enforcement of Betterment Levy Act wherever enacted is called for. With the advent of irrigation there is great appreciation in the price of lands. States in which this provision has not been enacted so far may proceed to levy this legitimate tax.

CHANGED PURPOSE AND PROSPECT OF IRRIGATION

6.37. One thing, however, is clear that the purpose and prospect of irrigation have to change radically in the present situation of food shortage that the country faces. State irrigation works, which, have so far been revenue oriented have to be made primarily production oriented.

6.38. This will require wide policy decisions at higher levels. A probe in this question seems imminently called for so that a reorientation of purpose and prospect of irrigation works is brought about in the country as early as possible.

6.39. The subject of irrigation is not only complicated but has wide ramifications impinging on agriculture almost directly and on cooperative movement, marketing facilities, transport development and other like disciplines indirectly. Keeping all such factors in view it will seem necessary to lay down some concrete policy decisions with regard to further development of irrigation.

6.40. Also no irrigation work be deemed as completed till development of irrigated agriculture has taken place in the areas catered for. In other words, irrigation projects should be framed comprehensively as projects for development of irrigated agriculture and not merely as irrigation projects.

INDIAN IRRIGATION COMMISSION

6.41. Further development of irrigated agriculture in the country, in fact, poses a variety of problems of unprecedented magnitude. Irrigation, as practised today is mostly patterned on a defensive basis and is broadly governed by principles outlined almost 60 years ago in Indian Irrigation Commission Report of

1901-03 modified to different extent in different States, according to irrigational development since the turn of the century.

6.42. It may, therefore, seem expedient to get this important aspect of our national economy looked into by a high level India Irrigation Commission, who may study the problems relating to locations, quantitative assessment of resources, creation of irrigation potential, possibilities of its speedy utilisation along with agroeconomic, administrative, financial and other aspects of development of irrigated agriculture from an all India point of view.

6.43. The Commission's report may provide broad guide lines for further development of irrigated agriculture not merely in its literal sense, but for irrigated agriculture oriented basically towards sustained increase in agricultural production, at least from irrigated lands.

APPENDICES

APPENDIX I

Terms of Reference of the Minor Irrigation Team

(*Vide* C.O.P.P. Memorandum No. C.O.P.P. (4) 17/58, dated August 4, 1958).

The minor irrigation projects may be divided for study into two parts:—

(*a*) Works already in existence.

(*b*) Works which are now being constructed.

2. Case studies should be made of a number of projects of each type under the above headings with a view of judging their efficiency having regard to the objectives with which such works were carried out.

3. The following points should be especially borne in mind:—

Existing Projects

(*i*) The present state of repair and maintenance.

(*ii*) The system of keeping works in proper maintenance with particular reference to the customary obligations of villagers for keeping such works in a sound condition from year to year, the team should also examine the extent to which these obligations are enforced, the reasons for the failure to do so and the steps that should be taken to carry out such obligations efficiently.

(*iii*) Reasons, if any fo rnon-utilisation of water by cultivators.

(*iv*) Improvements necessary to make the projects more efficient either in the matter of better agricultural planning and practices or in respect of engineering works.

(*v*) Cost of restoration if the project is in a state of disrepair and whether it has been included in the Plan.

New Projects

(*i*) Method of selection, procedure and principles on which priorities are based.

(*ii*) Flow Chart of the construction Project should be prepared to examine whether any avoidable delay has occurred in its completion.

(*iii*) Whether fullest use is made of catchment capacity in preparing design.

(*iv*) Economics of design.

(*v*) State of agricultural planning with a view to optimum utilisation of benefits.

(*vi*) Institutional arrangements provided for the proper maintenance of new works with special reference to the customary obligation of villagers in this regard.

(*vii*) Cost of actual construction compared to estimated costs—the reasons for increase, if any, and the care with which the initial estimates were framed.

4. Any other matter which the Team considers necessary to report upon having a bearing on economy and efficiency of such projects.

5. The following information should be gathered by the Team for each State, taken as a whole in regard to existing minor irrigation works:—

(*i*) The total area irrigated from them according to Settlement registers.

(*ii*) The area actually irrigated from year to year beginning from 1947.

(*iii*) The reason for the reduction, if any, in the area irrigated

6. In addition, the Team will carry out a study of the tubewell schemes of the Punjab and the U.P. with reference to the fact whether optimum use has been made of the facilities available by ensuring scientific crop planning and by improving agricultural practices. The study should be based on an examination of individual tubewells, which may be divided into most successful, successful and least successful varieties for the purpose of study. The Team should also select a few tubewells for which alternative crop planning and practices may be recommended that are being carried out at present in order to make them more successful. The consideration mentioned regarding minor irrigation works in paragraph 3 *mutatis mutandis* be taken into consideration for the study of tubewells also.

APPENDIX II

Composition of the Irrigation Team—Its Leaders & Members

LEADERS	*MEMBERS*
1. Dr. N. V. Gadgil *Feb. 1957 to Sept. 1959.*	Shri M. Narsimhaiya *(Retd. Chief Engineer, Mysore)* *March 1958 to Feb. 1959.*
2. Dr. A. N. Khosla *Sept. 1959 to Dec. 1960.*	S. B. Lal Singh, *(Retd. Director Agriculture Punjab)* *March 1958 to July 1960.*
3. Shri M. Thirumala Rao *Dec. 1960 to date.*	Shri Baleshwar Nath, *(Chief Engineer)* *March 1960 to Date.*
	Dr. Arjan Singh, *(Retd. Director Agriculture Punjab)* *Aug. 1960 to Date.*
	Shri Mahavir Prasad, *(Ex-Officio)* *Irrigation Adviser, Ministry of Food & Agriculture*
	Dr. K. Ramiah, *Co-opted Member for Punjab only.*

APPENDIX III

ORGANISATIONAL SET-UP OF MINOR IRRIGATION WORKS IN DIFFERENT STATES

1. *Andhra Pradesh*

In Andhra Pradesh, tanks with ayacuts of 200 acres, and above are looked after by the State P.W.D. and the rest by the Revenue Department through their minor Irrigation Staff. In Telangana region this limit is, however, 100 acres.

2. *Assam*

All minor irrigation works are looked after by the P.W.D. Irrigation Branch excepting State Tubewells which are in charge of Agriculture Department.

3. *Bihar*

State tubewells, and minor irrigation works constructed under the Bengal Irrigation Act of 1876 are with the P.W.D. (Irrigation). Execution of works under the Bihar Private Irrigation Works Act of 1922, and the Bihar Public Irrigation and Drainage Works Act of 1947 is done by the Directorate of Minor Irrigation, Department of Agriculture. For operation and maintenance they are handed over to the Panchayat Samities after completion.

4. *Gujarat*

Construction and maintenance of State tubewells, and minor irrigation works irrigating 250 acres and above is with the P.W.D., those below 250 acres are with the Revenue Department. With the introduction of Panchayati Raj, Panchayats have since 1st April, 1963 taken over such responsibility from the Revenue Department.

5. *Himachal Pradesh*

All types of minor irrigation works are constructed and maintained by the State P.W.D. Building and Roads Branch.

6. *Jammu and Kashmir*

Under the J. & K. Valley Panchayats Act 1958, maintenance of minor irrigation works has been entrusted to Panchayats.

7. *Kerala*

Formerly in Travancore region works irrigating upto 5 acres were maintained by the beneficiaries themselves, and above 5 acres by the P.W.D. In old Madras State this limit was 200 acres.

8. *Madhya Pradesh*

The minor irrigation programme financed from different sources are under the unified control of the Chief Engineer, Irrigation through a Deputy Chief Engineer, minor irrigation. At the District and Block levels there are special Minor Irrigation Sub-Divisions under the control of the concerned Executive Engineers and Superintending Engineers of the Irrigation Department.

9. *Madras*

All "system" tanks drawing their supplies from rivers across which anicuts have been constructed and "non-system" tanks with ayacuts of more than 200 acres are with the P.W.D. The Revenue Department is responsible for maintenance of all other irrigation tanks with ayacuts upto 200 acres.

10. *Maharashtra*

Execution and maintenance of minor irrigation works irrigating 250 acres and above is with the P.W.D. and those irrigating below 250 acres, which were formerly with the Revenue Department, have since been transferred to the Zila Parishads.

11. *Mysore*

Minor Irrigation tanks are under the administrative control of the Revenue Department. Responsibility for their maintenance is, however, of the beneficiaries (Ryots) concerned. But for lack of fulfilment of customary obligations maintenance of most of the tanks had to be ensured through the Public Works Department, the cost being recovered from the cultivators in instalments.

12. *Orissa*

All minor irrigation programmes financed from various sources are executed and maintained by the Rural Engineering Organisation headed by a Chief Engineer who is under the administrative control of the State Development Commissioner.

Agriculture department handles State tubewells and other lift irrigation schemes.

13. *Punjab*

All minor irrigation works and State tubewells are in the charge of P.W.D., Irrigation Branch.

14. *Rajasthan*

(*a*) Tanks and reservoirs irrigating upto 50 acres are now managed by Panchayat Samitis.

(*b*) Tanks irrigating from 51 to 2,500 acres are controlled by the Revenue Department with regard to distribution of their water supply and assessment of water rates. Their maintenance is in the charge of Irrigation Department.

(c) Tanks with capacity to irrigate more than 2,500 acres are under the control of Irrigation Department with regard to maintenance, regulation and assessment.

15. *Uttar Pradesh*

State tubewells are under the management of Irrigation Department, while other minor irrigation works have since been transferred from Irrigation Department to the newly created organisation under the control of Agriculture Production Commissioner.

16. *West Bengal*

Agriculture Department executes and maintains minor irrigation works, tubewells and other lift irrigation schemes costing individually upto Rs. 1 lakh. All irrigation works costing above Rs. 1 lakh are in the jurisdiction of the Irrigation and Waterways Department.

APPENDIX IV

Legislation for construction and maintenance of Field Channels in various States

S. No.	Name of State	Present position
1.	Punjab	The Northern India Canal and Drainage (amendment) Act, 1958 provides for the construction and maintenance of water courses and field channels.
2.	Uttar Pradesh	Block Development Officers and Gaon Sabhas have been made responsible for construction and maintenance of water courses and field channels. The Northern India Canal and Drainage (U. P. Amendment) Oridinance, 1963 was promulgated on 29-1-1963 so that in case a Gaon Sabha failed to construct field channels within a stipulated period, the State Government (Irrigation Department) could carry out the work departmentally and recover the cost thereof from the beneficiaries. The Ordinance had subsequently been replaced by a regular Act of the State Legislature in February 1963.
3.	Rajasthan	Rajashtan Irrigation and Drainage Act No. XXI of 1954 envisage water courses as responsibility of the beneficiaries. Later the Rajasthan Irrigation and Drainage, (Amendment) Act, 1960 was passed in May, 1960.
4.	Gujarat	An Act amending the Bombay Irrigation Act, 1879 (Gujarat Amendment Act, 1962) in order to provide for expeditious acquisition of land for construction of water courses by the benficiaries has been passed by the State Legislature in January, 1963.
5.	Maharashtra	Maharashtra Act No. XLVII of 1965 amending the Bombay Irrigation Act, 1879. The Hyderabad Irrigation Act No. 24 of 1357 F. and the C. P. Irrigation Act III of 1931 as applicable to the State provides powers to canal officers for taking up schemes for compulsory construction of water courses.
6.	Andhra Pradesh	Andhra Pradesh Act No. 12 of 1956 has recently been enforced and controls the construction and maintenance of water courses.

Sl. No.	Name of State	Present position
7.	Mysore . .	The Mysore Irrigation Bill providing for construction and maintenance of water courses and field channels has been placed before the State Legislative Assembly. In the meantime, the Government have issued an order (*vide* No. PWD 219 MTP 60 dated 3/6/12-/62) according approval to the construction and maintenance, at Government cost, of field channels upto the last survey No. wherever necessary pending recovery of cost from the beneficiaries.
8.	Madras. .	The Madras Irrigation Works (construction of Field Bothies) Act , 1959 provides for construction and maintenance of water courses and field channels.
9.	Kerala . .	No legislation exists. Suitable provisions are being made in the Kerala Irrigation Bill for construction and maintenance of water courses and field channels.
10.	Orissa . .	The Orissa Irrigation Act, 1959 provides for this.
11.	Assam .	No legislation exists. Usual practice is for cultivators to construct field channels themselves.
12.	West Bengal .	The question had been referred to Ministry of Law as the State Government had informed the Planning Commission that it is not legally valid to enforce the obligation for construction and maintenance of field channels on the beneficiaries.
13.	Bihar . .	There is no legislation existing. As per Bihar Panchayati Raj (Amendment and Validity) Act, 1959 the construction and maintenance etc. of water courses and field channels will be the responsibility of Gram Panchayats. Necessary amendment in the relevant State Irrigation Act to ensure proper discharge of the obligation of the benficiaries has been taken up.
14.	Madhya Pradesh	Central Provinces Irrigation Act III of 1931 Section 4 envisages water courses, as beneficiaries responsibility. Later the Madhya Pradesh Irrigation (Amendment) Act, 1960 was passed on 1-11-1960.
15.	Jammu & Kashmir	The Government is empowered to construct water courses at the expense of the beneficiaries, in case of default.

APPENDIX V

Extract copy of letter No. 3(33)/62-Agri., dated November 20, 1962 from Ministry of Community Development, Panchayati Raj & Co-operation, Government of India to Secretaries, Community Development of all States.

SUBJECT:—Construction and maintenance of field channels—Enforcement of responsibilities on beneficiaries.

You are aware that the question of full utilization of irrigation potential was pointedly brought up at the meeting of the National Development Council held at Delhi on the 4th and 5th instant as one of the immediate step for maximising agricultural production in the present emergency. *It has been estimated that potential to the extent of 3·0 million acres for major and medium irrigation works alone (as per statement I enclosed) remained unutilised at the end of Second Plan.* The scheme wise details of irrigation potential remained unutilized in your State are shown in Statement II. *The unutilized potential for minor Irrigation Works is believed to be higher still.* The compelling urgency of utilizing the available potential needs no emphasis and construction of field channels, among other things, is one of the most important steps in this process.

APPENDIX VI

Copy of letter No. 3-2(7)/61-Agri., dated the 21st October, 1961 from the Planning Commission, Government of India, New Delhi, to the Development Commissioner/Planning Secretaries, all States. States.

SUBJECT:—Minor Irrigation survey and coordination of major, medium and minor irrigation works.

The major and medium irrigation works that are proposed to be taken up during the coming ten years are broadly known. The Central Water and Power Commission is preparing basin-wise reports on technological possibilities of irrigation projects showing the location of major projects, the irrigation potential of which is estimated at about 100 million acres. For minor irrigation, although the position in regard to the potentialities is not precisely known, a study on the subject of natural resources places the most minor irrigation potential of the country at 75 million acres. A perspective view has, therefore, to be taken in regard to location of areas for major and minor irrigation schemes, and allocation of priorities as also funds for their execution by different agencies. District-wise information regarding the existing minor irrigation works is available in many of the States. However, there is distinct need for coordinating planning and investigation of future minor irrigation possibilities at the district level.

2. The need for undertaking systematic surveys was recognised by the Regional Minor Irrigation Conferences held in 1958, who had recommended setting up of properly staffed and equipped investigation units with definite jurisdictions, for the purpose. The Annual Conference of Community Development held in Srinagar in 1960, had recommended setting up of properly staffed and equipped investigation and Agriculture and Planning Departments should assess the irrigation requirements and possibilities in the Block and prepare Plan of works to be undertaken. The States may have already initiated action in implementation of these recommendations.

3. In compact areas where large number of minor irrigation works are in existence, care will have to be taken to see that they are not wasted on account of the execution of new major and medium irrigation projects. Similarly, in intensifying efforts for undertaking new minor irrigation works it should be seen that such works are not concentrated in areas where adequate perennial irrigation will be available before long through major and medium irrigation works. It would also be worthwhile to combine the system of flow irrigation and lift irrigation so as to maximise the use of stored water over a larger area and obviate the danger of water-logging.

4. The minor irrigation works may include, among others, tanks, diversion channels, lift irrigation works and tube or percolation wells. The State Governments may indicate location only in respect of such works as are estimated to irrigate more than 100 acres. In regard to the rest, only the number and the estimated area to be irrigated under each category of works in a block or the district should be shown. The State Governments may also consider listing in a separate category works which cannot be justified strictly on grounds of financial returns but are recommended for execution as relief works as and when the need for them arises.

5. It is suggested that the State Governments may kindly prepare irrigation maps for the State as a whole indicating areas which will be served (1) by major and medium irrigation, (2) minor irrigation schemes with or without soil conservation schemes and (3) by soil conservation schemes. Such maps should be ready as soon as possible, preferably, in about a year's time so that a coordinated irrigation programme for the country as a whole can be drawn up for use of all agencies concerned with the subject.